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Improving Social Interaction between Students with Autism Spectrum Disorder and Their Peers in Inclusive Settings

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Improving Social Interaction between Students with Autism Spectrum Disorder and Their Peers in Inclusive Settings

by

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Dedication

In loving memory of Alex Christopher Watkins.

Acknowledgements

This work is dedicated to my little brother Alex Christopher Watkins, who passed away during the time I was working on my dissertation. Alex was a major reason why I began working with children with disabilities, and in this way, he continues to influence the work I do today. I wish he could be here to share in this moment, but the memory of his humor, compassion, and indomitable spirit will be forever with me.

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Improving Social Interaction between Students with Autism Spectrum Disorder and Their Peers in Inclusive Settings

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As the inclusion of students with autism spectrum disorder (ASD) in settings with typically developing peers has become a recommended practice in education, children with ASD are spending increasing proportions of their day in such environments. Despite inclusion in settings with typically developing peers, researchers have found limited interaction and social acceptance between children with ASD and their typically developing classmates. Given the difficulties children with ASD have with social interaction, interventions must be employed in order to increase peer interaction between students in inclusive classroom settings.

Evidence suggests that incorporating the circumscribed or preferred interests of children with ASD into activities can produce large increases in social behavior without the need for utilizing an additional social skills intervention. However, these studies have not involved students with more severe symptoms of ASD and the social validity of this intervention strategy has not been rigorously assessed. Further, research involving young children has taken place outside the natural classroom context, and the generalization and maintenance of results have not been assessed.

Therefore, the purpose of this study was to evaluate whether incorporating the preferred interests of young children with ASD into play activities mutually engaging to typically developing peers would result in an increase in social interaction within the natural classroom environment. A multiple baseline design across four participant and peer dyads with an embedded reversal was used to demonstrate the effects of the intervention on social interaction during play sessions with typically developing classmates. Generalization with novel peers was assessed across all conditions, and maintenance was assessed six weeks post treatment. In addition, intervention effects across additional skill domains (i.e., functional play, stereotypy) were also assessed.

Results indicated that social interaction and the duration of interactive play with peers increased for all participants, and generalization to novel peers was observed. In addition, functional play increased and stereotypy decreased for one participant. Treatment gains were maintained during six-week follow- up sessions. Recommendations for practitioners working with children with ASD in inclusive settings and potential areas of future research are discussed.

Table of Contents

List of Tables

List of Figures

CHAPTER 1: Introduction

An estimated 1 in 68 school-aged children in the United States is diagnosed with autism spectrum disorder (ASD; Center for Disease Control, 2014). Federal mandates such as the Individuals with Disabilities Education Act (IDEA) require that students with ASD be educated alongside typical peers in regular education environments to the greatest extent possible (IDEA 2004). Although many of these students receive special education services in self-contained or resource classrooms specifically for students with disabilities, a growing population of students with ASD receive special education services in inclusive settings where they are educated alongside their typically developing peers (Camargo et al., 2014; Koegel et al., 2012d; Watkins et al., 2015). In 2000, only 18.3% of students with ASD served under IDEA spent 80% or more of the school day in general education environments. By 2013, this number had grown to 39.7% of students with ASD spending 80% or more of the school day in general education settings, with another 18.2% of students with ASD spending 40% - 79% of their school day in general education settings (U.S. Department of Education 2015).

Students with ASD experience significant challenges that may hinder their success in inclusive settings. Interaction and communication with classmates and teachers and participation in classroom activities can be difficult due to social communication deficits that are central to the diagnostic criteria of the disorder (American Psychiatric Association [APA], 2013). Restricted and repetitive interests or behaviors exhibited by students with ASD may also negatively affect both academic achievement and social relationships (APA, 2013; Lanovaz et al., 2013). In addition, challenging behaviors such

as aggression or elopement that are common in students with ASD (Matson & Nebel-Schwalm, 2007) may be a barrier to the successful inclusion of these students in general education classrooms (Dunlap et al, 2010; Crosland & Dunlap, 2010; Emerson et al., 2001).

The social skills of these students have been of particular concern because, compared to the other core deficits associated with ASD, social deficits may improve less as the child ages (Anderson et al., 2014; Bauminger, 2002). As such, improvements in social skills are often identified as top treatment concerns for children with ASD (e.g., Lang et al., 2009; Pituch et al., 2011). Students with ASD exhibit social deficits that can include difficulties initiating interaction, responding to initiations made by others, and maintaining social engagement (Koegel et al, 2008; Volkmar et al., 1997). These deficits can lead to challenging behavior, academic difficulties, and withdrawal and isolation from the peer group (Camargo et al., 2014; Lang et al., 2010). Despite inclusion in settings with typically developing peers, researchers have found limited interaction and social acceptance between children with ASD and their typical classmates (McConnell, 2002; Odom et al., 2006; Pierce & Schreibman, 1997). Given the difficulties children with ASD have with social skills, interventions that are both effective in increasing peer interaction and are feasible to implement in inclusive classrooms are needed if students are to experience gains in this setting.

Many studies have shown that behavioral strategies such as modeling, prompting, and contingent reinforcement have resulted in increases in play and social interaction for young children with ASD (Camargo et al., 2014; Lang et al., 2009; Wong et al., 2015).

Such strategies are often components of evidence-based interventions frequently implemented with this population, including peer-mediated interventions (e.g., Jung et al., 2008; Katz & Girolametto, 2013), video modeling (e.g., Buggey et al., 2011), and social skills group instruction (e.g., Garfinkle & Schwartz, 2002). These interventions, however, often require consistent and direct adult involvement, as well as additional treatment components (e.g., persistent prompting to maintain interaction, implementation of high and low probability request sequences, creation of specialized materials) that teachers or practitioners in inclusive settings may find inefficient (Watkins et al., 2015). Furthermore, research has shown that general education teachers may not have knowledge of evidence-based behavioral strategies for students with ASD (Pazey et al., 2014; Segall & Campbell, 2012), so interventions that can be reasonably implemented by practitioners in this setting are needed.

Evidence suggests that incorporating the circumscribed or preferred interests of children with ASD into activities with typical peers in inclusive settings can produce large increases in social behavior without the need for utilizing a more specialized social skills intervention. For example, Koegel et al created clubs around the preferred or circumscribed interests of children and adolescents with ASD that resulted in an increase in social engagement and the number of initiations participants made to typical peers (Koegel et al., 2012a, 2012b, 2013). Similarly, Baker et al created thematic playground games around the obsessive interests of elementary school children with ASD, resulting in an increase in appropriate social interaction with peers (Baker et al., 1998). Finally, Boyd et al found that higher percentages of peer social interaction in kindergarteners with

ASD occurred when their highly preferred interests were embedded into play sessions compared to play sessions that utilized less preferred interests (Boyd et al., 2006).

These findings are promising and would seem to offer practitioners in inclusive settings an efficient and effective strategy for increasing peer-to-peer interaction. However, these findings are limited as the studies included higher functioning participants with well-developed verbal skills (e.g., Baker et al., 1998; Koegel et al., 2012a, 2012b, 2013); therefore, it is unknown if these strategies will be effective for children outside this range of functioning. In addition, studies employing circumscribed interests with children with ASD in early childhood settings (e.g., Boyd et al., 2006) have occurred in locations outside of the typical classroom context and have not assessed the generalization or maintenance of results, which further limits the generalizability of the intervention to this subset of the population. Further, these studies have not assessed potential improvements in other skill domains, such as increases in play skills or decreases in stereotyped behavior. As social skills interventions have been shown to often produce improvements in behavior across multiple domains (Ledbetter-Cho et al., in review), it would seem prudent to additionally examine potential gains in other skills. Finally, these studies have not rigorously assessed the social validity of this intervention approach, so the feasibility of utilizing this strategy in an inclusive classroom has not yet been determined.

Therefore, the purpose of this dissertation is to extend previous research by incorporating the preferred interests of young children with ASD into play activities that are also appealing to typical classmates within the context of the natural inclusive

classroom setting. Specifically, this dissertation will seek to answer the following research questions:

1.) Will the incorporation of the preferred interests of preschoolers with ASD into activities with typical classmates increase peer interaction for a variety of participant profiles, ranging from high to low functioning ASD diagnoses?

2.) Will intervention results generalize to novel peers and maintain following the intervention?

3.) Will this strategy additionally occasion improvements in other skill domains?

4.) Is this intervention feasible in an inclusive classroom environment according to multiple indicators of social validity?

CHAPTER 2: Interventions of Students with Autism Spectrum Disorder in Inclusive Classroom Settings: A Meta-Analysis of the Literature

As the inclusion of students with disabilities in settings with typically developing peers has become a recommended practice in education, the inclusion of students with autism spectrum disorder (ASD) in regular education settings is steadily increasing (DiSalvo & Oswald, 2002; Watkins et al., 2015). In order for students with ASD to experience academic, social, and behavioral gains in inclusive environments, appropriate supports must be in place. Further, the Individuals with Disabilities Education Act (IDEA) requires that schools implement scientific, evidence-based interventions for all students with disabilities; thus, it is vital that practitioners in inclusive settings are capable of implementing research-based strategies for this population (IDEA 2004).

Previous reviews of the literature have examined interventions targeting skills within a particular domain (e.g., social skills; Camargo et al., 2013) or specific intervention strategies (e.g., peer-mediated interventions; Chan et al., 2009; Watkins et al., 2015) for students with ASD in inclusive classrooms. Other reviews have provided descriptive summaries of trends and intervention strategies for students with ASD in general education settings (e.g., Crosland & Dunlap, 2012; Koegel et al., 2012d). However, to date there is no comprehensive examination of research for this population that quantitatively analyzes the efficacy of interventions for students with ASD in inclusive settings across a variety of skill domains. Furthermore, scant attention has been focused on the social validity of these interventions (Callahan et al., 2008). In order to advance evidence-based practice, it is vital to not only determine the effectiveness of an

intervention but also examine whether certain strategies are socially valid in inclusive classrooms and thus more likely to be adopted by practitioners in these settings (Kennedy, 2002; Kucharczyk et al., 2015; Lang & Page, 2011).

Therefore, the purpose of this meta-analysis is to examine the characteristics of interventions for students with ASD in inclusive settings, analyze the social validity of these interventions, offer an analysis of intervention effects and research design, examine potential moderating variables that influence outcomes, and provide recommendations for practice and future research.

METHOD

Protocol Registration and PRISMA Guidelines

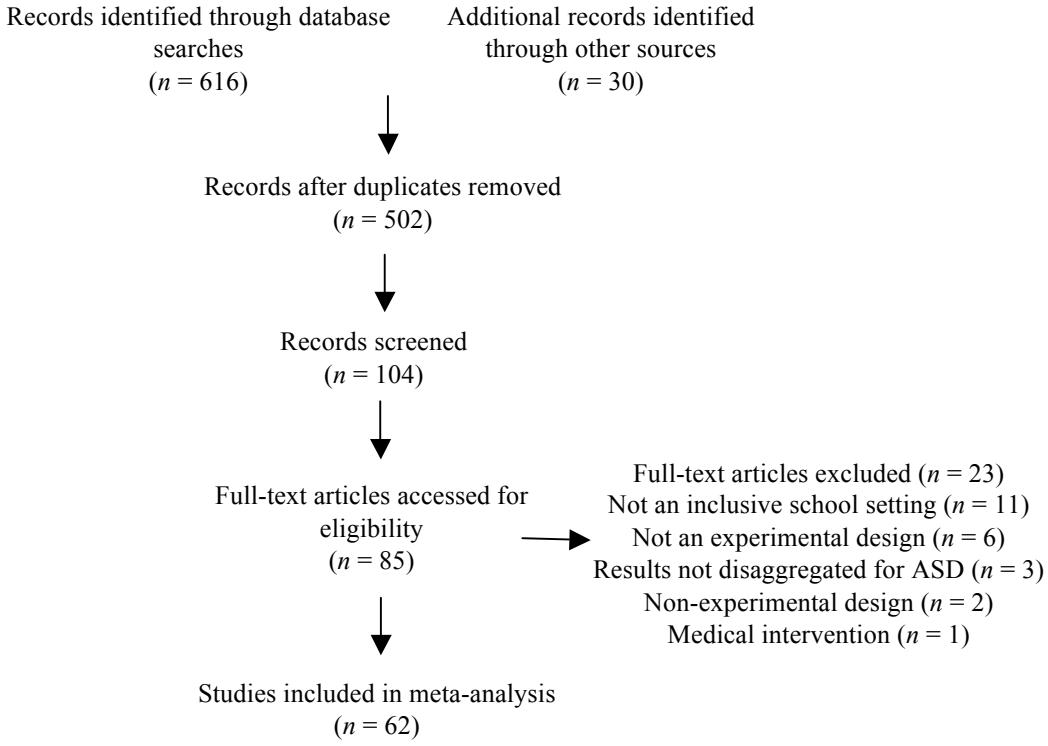
The protocol for this meta-analysis was registered with the PROSPERO International prospective register of systematic reviews (Watkins & O'Reilly, 2016) and was conducted in accordance with PRISMA guidelines (Moher et al., 2009).

Systematic Search Procedures

A search was conducted using the PsycINFO®, Education Resources Information Centre (ERIC), and Medline databases using the terms autis* or ASD or Asperger* or pervasive developmental disorder*; intervention or treatment or program; and inclus* or general education. The search was restricted to English language peer-reviewed studies published between 1996 through 2016. In order to identify relevant studies potentially missed by electronic search, ancestry searches of included articles were conducted, and citations that appeared potentially relevant were considered for inclusion. In addition, searches of literature reviews and meta-analyses that were returned from keyword

database searches were conducted in order to identify further studies to consider for inclusion. A total of 502 records, published between 1996 and 2016, resulted from this multistep search procedure. Of these records, 104 abstracts were identified for screening. Eight-five full-texts were then accessed for eligibility, with a total of 62 articles meeting the criteria for inclusion in the meta-analysis. Figure 1 depicts the search and screening process.

Figure 1. Flowchart of included studies



Inclusion Criteria

Inclusion criteria were developed prior to the literature search. Studies included in this review were interventions conducted in an inclusive school setting that targeted a

skill deficit or behavioral excess displayed by a student age 3 – 21 years old diagnosed with autism spectrum disorder, including Asperger syndrome, autistic disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS). If studies incorporated participants with other diagnoses, only the disaggregated data for participants with ASD were considered (e.g., Barton, 2015; Hughes et al., 2013a). Studies that did not disaggregate data for participants with ASD were excluded (e.g., Carter et al., 2015).

Inclusive school settings were defined as those in which the student with ASD shared the context and activities with typically developing classmates (Watkins et al., 2015). As inclusion refers to the placement of special education students in general education settings (Camargo et al. 2014; Mesibov & Shea 1996), studies that took place in a self-contained special education class were excluded (e.g., Banda & Hart 2010; Kuhn et al. 2008). Furthermore, the study had to include an intervention that focused directly on a skill deficit (e.g., social communication skills, play skills, academic skills) or behavioral excess (e.g., challenging behavior, stereotypic or restrictive and repetitive behavior). Finally, the study must have used an experimental research design that allowed for direct analysis of the effect of the intervention on participant behavior (i.e., single case design or group comparison design). Studies that did not utilize an experimental design were excluded. A total of 62 articles met these criteria and are included in this meta-analysis.

Data Extraction

Each included study was summarized in terms of: (a) research design; (b)

participant gender, age, and functioning level; (c) intervention agents and strategies; (d) skill domain and target behaviors; (e) intervention effectiveness; and (f) the strength of the research report. Individual study summaries are provided in Table 1.

An estimation of participants' functioning level was determined by applying the schema provided by Reichow and Volkmar (2010). According to this schema, participants classified as lower functioning had limited or no verbal language skills and/or an IQ < 55. Participants classified at a moderate functioning level had basic verbal communication skills and/or an IQ of 55-85. Participants classified as high functioning were described as having high-functioning autism or Asperger's Syndrome, had well developed verbal communication and/or an IQ > 85.

Interventions were classified by strategies as described by the authors of the studies in order to provide a gross estimation of the techniques and methods used during treatment sessions (Reichow & Volkmar, 2010). Outcomes for each study were broadly categorized according to skill domain. These included social communication skills (i.e., verbal and nonverbal behaviors used to interact and convey meaning with others), restricted and repetitive behavior (i.e., restricted, repetitive patterns of behavior, interests, or activities), play skills (i.e., behaviors involved in symbolic, functional or symbolic play), challenging behavior (i.e., disruptive behaviors such as tantrums, aggression, and self-injury), academic skills (i.e., skills needed for proficiency in content areas such as language arts, math, science, and social studies), and classroom behavior (i.e., adaptive behaviors needed for successful classroom participation such as hand-raising, sitting at desk, or attending to a teacher or task). The specific target behaviors or outcome

measures within each skill class were also coded.

Finally, the presence or absence of numerous social validity indicators for each study was coded. Studies demonstrated the social validity of the intervention by indicating at least four of the following: socially important dependent variable, time and cost effective intervention, clinically significant behavior change, normative comparisons between individuals with and without disabilities, consumer satisfaction with the results, independent variable manipulated by people typically in contact with the participant, and/or intervention provided in natural contexts (Reichow et al., 2008).

Intervention Effectiveness

Tau-U, a nonparametric statistic suitable for single-case research design, was calculated in order to provide an analysis of intervention effectiveness in each single-case design study. Tau-U measures the amount of overlap between two phases and is well suited to small data sets typical to single-case design research. As Tau-U follows the "S" sampling distribution, p-values and confidence intervals are available. In addition, Tau-U also controls for positive data trend (monotonic trend) in the baseline phase (Parker et al., 2011). For studies utilizing group designs, Cohen's *d* was calculated for post treatment groups for each reported variable using means and standard deviations (Cohen, 1988). Cohen's *d* is defined as the standardized difference between group means and is common in meta-analysis of group design studies (Warner, 2012). Effect sizes of .20 and lower are considered small, values from .21 to .79 moderate, and values at or above .80 large. Statistical significance was determined using confidence interval CI_{95}. A 90% - 95% confidence interval is standard when determining whether change is reliable, indicating a

reasonable change of 5 - 10% likelihood of error (Nunnally & Bernstein, 1994).

In addition to quantitative analysis of the individual studies, mean effect sizes across studies were also calculated for different study features (i.e., skill class, participant age and functioning level, intervention agent, and social validity indicators) to analyze potential moderating influences. These results are presented in Table 2.

Quality of Research

The quality of the research report was determined by applying the Evaluative Method for Determining Evidence-Based Practices in Autism developed by Reichow, Volkmar, and Cicchetti (2008). This method has been shown to produce reliable and valid results in the assessment of primary and secondary quality indicators of experimental design reports (Cicchetti, 2011; Wendt & Miller, 2012).

Single case design studies received ratings on six primary quality indicators including participant characteristics, independent variable, dependent variable, baseline condition, visual analysis, and experimental control. These studies also received ratings on six secondary quality indicators including interobserver agreement (IOA), kappa, fidelity, blind raters, generalization and/or maintenance, and social validity. Single case design studies were rated as having strong, adequate, or weak research strength. Studies rated as strong received high quality ratings on all primary indicators and showed evidence of three or more secondary quality indicators. Studies rated as adequate received high quality ratings on four or five primary quality indicators with no unacceptable quality ratings on any primary quality indicators, and showed evidence of at least two secondary quality indicators. Studies rated as weak received fewer than four

high quality ratings on primary indicators or showed evidence of less than two secondary quality indicators (Reichow et al., 2008).

Group design studies received ratings on six primary quality indicators including participant characteristics, independent variable, comparison condition, dependent variable, link between research questions and data analysis, and the use of statistical tests. These studies also received ratings on eight secondary quality indicators including random assignment, interobserver agreement (IOA), blind raters, fidelity, attrition, generalization and/or maintenance, effect size, and social validity. Group design studies were rated as having strong, adequate, or weak research strength. Studies rated as strong received high quality ratings on all primary indicators and showed evidence of four or more secondary quality indicators. Studies rated as adequate received high quality ratings on at least four primary indicators with no unacceptable ratings on any primary quality indicators, and showed evidence of at least two secondary quality indicators. Studies rated as weak received fewer than four high quality rating on primary indicators or showed evidence of less than two secondary quality indicators (Reichow et al., 2008).

Table 1. Summary of interventions for students with ASD in inclusive classroom settings

Reference	**Design**	**Participants and FXN level**	**Intervention agent and strategies**	**Number of social validity indicators**	**Skill class and target behaviors**	**ES and 95% CI**	**Strength of research**
Apple et al., 2005	MBD across participants	3 males; 1 female; 4 and 5 years; high	Teacher: Video modeling, self-monitoring	4	Social skills: compliments, responses	.77 [.54, .99]	Adequate
Banda et al., 2010	MBD across participants	2 males; 6 years; high	Researcher, peers: Direct instruction, PMI	3	Social communication skills: initiations, responses	1 [.67, 1]	Weak

Table 1. Cont.

Banda et al., 2012	AB across 3 settings	1 male; age NR (3rd grade); high	Teacher: Noncontingent attention	3	Challenging behavior: disruptive vocalizations	67 [.29, 1]	Weak
Barton, 2015	MBD across behaviors	2 males, 1 female; 3 and 5 years; moderate	Teacher: System of least prompts and contingent imitation	4	Play skills: pretend play, symbolic play	.77 [.63, .92]	Strong
Blair et al., 2007	MBD across settings	1 male; 6 years; low	Teacher: FBA, physical prompting, modeling, time delay	6	Challenging behavior: out of seat, aggression, inappropriate vocalizations	1 [.78, 1]	Adequate
					Classroom behavior: engagement with materials, following directions	.92 [.33, 1]	
					Social communication skills: communication with picture cue cards	1 [.43, 1]	
Bock, 2007	MBD across settings	1 male; 12 years; high	Teacher: Behavioral skills training	7	Social communication skills: interaction	.97 [.43, 1]	Adequate
					Play skills: game playing	1 [.58, 1]	
					Classroom behavior: cooperative learning	1 [.52, 1]	
Buggey, 2010	MBD across behavior and participants	4 males; 6, 8, 9 and 11 years; high	Researcher: Video self-modeling	5	Social communication skills: initiations, response, unsolicited verbalizations	.85 [.58, 1]	Adequate
					Challenging behavior: tantrums, pushing	.98 [.62, 1]	
Callahan & Rademacher, 2007	MBD across settings	1 male; 8 years; high	Researcher: self-monitoring, reinforcement, modeling, role-play	3	Classroom behavior: on task behavior	.65 [.29, 1]	Adequate
Carter et al., 2005	ABAB and BABA	1 male, 1 female; 12 and 13 years; low	Teacher, peers: PMI	3	Social communication skills: peer interaction	-.19 [-.48, .09]	Adequate
					Academic skills: curricular contact and consistency	-.18 [-.48, .10]	
Casey & Merical, 2006	MBD across settings	1 male; 11 years; high	Agent NS: FA, FCT	2	Challenging behavior: self-injury	.69 [.19, 1]	Weak
					Social communication skills: asking for a break	.19 [-.31, .69]	

Table 1. Cont.

Chan et al., 2011	MBD across participants	3 males; 8 years; high	Teacher: Social Story	6	Classroom behavior: appropriate sitting, attending to teacher, independent work	.38 [.11, .65]	Adequate
Cihak et al., 2010a	Multiple probe across settings, embedded ABAB	3 males; 11 and 13 years; high	Teacher: Self-monitoring with static picture prompts	6	Classroom behavior: task engagement	.98 [.82, 1]	Strong
Cihak et al., 2010b	ABAB MBL across participants	3 males, 1 female; 6, 7, 8 years; low	Teacher: video modeling, least to most prompts, reinforcement	6	Classroom behavior: transitions	.96 [.69, 1]	Strong
Conroy et al., 2005	Alternating treatment	1 male; 6 years; high	Researcher: FA, direct instruction, visual cues	3	Classroom behavior: engagement	.84 [.28, 1]	Weak
					RRB: hand flapping	-.01 [-.56, .55]	
Crozier & Tincani, 2006	ABAB and ABACBC	3 males; 3 and 5 years; high	Researcher: Social Story, verbal prompts	3	Classroom behavior: appropriate sitting	.76 [.23, 1]	Adequate
					Social communication skills: peer interaction	.62 [.09, 1]	
					Play skills: play with peers	.84 [.49, 1]	
Eldevik et al., 2012	Group comparison	33 males, 10 females; 2–6 years; high, moderate, low	Teacher: Early intensive behavioral intervention, differential reinforcement, shaping, chaining, task analysis, and prompt and prompt fading	4	Social communication skills, academic skills, classroom behavior:		Adequate
					Intelligence	1.04 [.35, 1.75]	
					Adaptive behavior	.74 [.06, 1.42]	
					Communication	.75 [.06, 1.43]	
					Socialization	.95 [.25, 1.64]	
					BSID	1.03* [.34, 1.72]	
					VABS	.73* [.05, 1.36]	
Ganz & Flores, 2008	Changing criterion	3 males; 4 years; high	Researcher, peers: PMI, script training	3	Social communication skills: scripted and unscripted phrases, comments, responses	.61 [.42, .80]	Adequate
Gardner et al., 2014	ABAB and ABA	2 males; 14 and 18 years old; high, 1ow	Teacher, peers: Peer network	7	Social communication skills: interaction, engagement	.85 [.55, 1] .88	Strong
Garfinkle & Schwartz, 2002	MBD across participants	3 males; 3, 4, 5 years; low	Teacher, peers: small group instruction, least to most prompts, reinforcement, PMI	6	Social communication skills: interaction	.49 [.10, .89]	Adequate
					Play skills: play imitations	1 [.52, 1]	

Table 1. Cont.

Gena, 2006	MBD across participants	2 males, 2 females; 4 years; moderate	Teacher: Physical and verbal prompting, social reinforcement	6	Social communication skills: initiations, responses	.97 [.74, 1]	Adequate
Haley et al., 2010	Alternating treatment	1 male; 8 years; high	Teacher: Visual cues	6	RRB: vocal stereotypy	1 [.50, 1]	Adequate
Hanley-Hochdorfer et al., 2010	MBD across participants	3 males, 1 female; 6, 9, 11, and 12 years; high, moderate	Agent NS: Social Story	4	Social communication skills: initiations, responses	.06 [-.11, .23]	Weak
Harper et al., 2008	MBD across participants	2 males; 8 and 9 years; moderate, high	Researcher, peers: PMI, PRT	4	Social communication skills: initiations, turn-taking	.84 [.63, 1]	Weak
Hartzell et al., 2015	MBD across participants	1 female; 7 years; moderate	Researcher: Direct instruction, prompting, reinforcement	5	Social communication skills: engagement	.68 [.33, 1]	Adequate
Hochman et al., 2015	MBD across participants	4 males; 15 and 17 years; high, moderate, low	Teacher, peers: Peer network	7	Social communication skills: interaction, engagement	.98 [.75, 1]	Strong
Hughes et al., 2011	MBD across participants and settings	1 male, 2 females; 16, 20, and 21 years; moderate, low	Researcher, peers: PMI, visual communication books, prompting, reinforcement	5	Social communication skills: interaction, initiations	.97 [.89, 1]	Adequate
Hughes et al., 2013a	MBD across participants	2 males, 1 female; 16 and 17 years; moderate, low	Researcher, peers: PMI, self-monitoring	6	Social communication skills: interaction	.91 [.69, 1]	Adequate
Hughes et al., 2013b	MBD across participants	3 males, 3 female; 16, 17, and 18 years; moderate, high	Researcher, peers: PMI, visual communication books, prompting, reinforcement	6	Social communication skills: interaction, initiations, responses	1 [.74, 1]	Strong
Hundert et al., 2014	MBD across participants	1 male, 2 females; 4 and 5 years; moderate	Researcher, peers: Script training, PMI	3	Play skills: interactive play	.97 [.66, 1]	Strong

Table 1. Cont.

Jung et al., 2008	MBD across participants	3 males; 5 and 6 years; moderate, low	Researcher, peers: PMI, high probability request sequences, verbal reinforcement	4	Social communication skills: initiations, responses, interaction	.98 [.79, 1]	Strong
Kasari et al., 2012	Group comparison	54 males, 6 females; 15 1st graders, 18 2nd graders, 8 3rd graders, 11 4th graders, 8 5th graders; high	Researcher and peers: Comparison of PMI (PEER) and child-assisted intervention (CHILD)	3	Social communication skills, challenging behavior; results for PEER group: Social network salience STRS closeness Conflict score Playground engagement Isolation during recess	 .02 [-.36, .4] .71 [.32, 1.1] .58 [.2, 1] .40 [.02, .78] .61 [.22, .1]	Adequate
Kasari et al., 2016	Group comparison	109 males, 28 females; 6 – 9 years; moderate, high	Researcher: Comparison of SKILLS (didactic instruction for students with ASD) and ENGAGE (naturalistic interest based instruction with TD peers) social skills groups	4	Social communication skills, results for SKILLS group: Engagement with peers Joint engagement Isolation during recess Site effects (time spent in engagement)	 .53 [.18, .88] .36 [.02, .71] .55 [.20, .90] .40 [.05, .74]	Strong
Katz & Girolametto, 2013	MBD across participants	2 males, 1 female; 4 and 5 years; high	Teacher, peers: Direct instruction, visual cues, PMI, prompting	7	Social communication skills: interaction	.96 [.57, 1]	Adequate
Kern & Aldridge, 2006	MBD across participants	4 males; 3 and 4 years; high, moderate	Teacher: Music therapy, prompting, modeling, reinforcement	5	Social communication skills: interaction	.94 [.74, 1]	Strong
Koegel et al., 2012a	MBD across participants	3 males; 11, 13, and 14 years; high	Researcher: Naturalistic incorporation of preferred interests	5	Social communication skills: initiations, engagement	.98 [.77, 1]	Adequate
Koegel et al., 2012b	MBD across participants	2 males, 1 female; 9, 10, and 12 years; high	Researcher: Naturalistic incorporation of preferred interests	5	Social communication skills: initiations, social engagement	.91 [.66, 1]	Adequate

Table 1. Cont.

Koegel et al., 2012c	MBD across participants	2 males, 1 female; 5 and 6 years; high	Agent NS: Initiations training; PRT	3	Social communication skills: initiations, engagement, affect	.93 [.65, 1]	Adequate
Koegel et al., 2013	MBD across participants	6 males, 1 female; 14, 15, and 16 years; high	Researcher: Naturalistic incorporation of preferred interests	6	Social communication skills: initiations, engagement	.85 [.66, 1]	Adequate
Kohler et al., 2001	MBD across participants	4 males; 4 years; moderate, low	Teacher: naturalistic teaching strategies	4	Social communication skills: interaction	.89 [.66, 1]	Adequate
Kohler et al., 2007	MBD across peers	1 female; 3 years; moderate	Teacher, peers: PMI, visual cues, feedback, reinforcement	5	Social communication skills: interaction	.86 [.58, 1]	Adequate
Kretzmann et al., 2014	Group comparison	18 males, 6 females; 6-11 years; fxn NS	Teacher: Modeling, behavioral strategies NS	4	Social communication skills: peer engagement	1.34 [.45, 2.23]	Adequate
Levingston et al., 2009	MBD across behaviors	1 male; 10 years; fxn NS	Teacher: modeling, prompting, reinforcement, error correction	5	Academic skills: identification of math label, operation, larger number, smaller number, solution accuracy	1 [.59, 1]	Weak
Loftin et al., 2008	MBD across participants	3 males; 9 and 10 years; high	Researcher, peers: PMI, modeling, prompting, reinforcement, self-monitoring	4	Social communication skills: initiations, interaction	.93 [.70, 1]	Adequate
Mason et al., 2013	MBD across participants	3 males; 6 and 8 years; high, moderate	Teacher, peers: PMI, direct instruction, prompting, reinforcement	6	Social communication skills: communicative acts	.98 [.67, 1]	Strong
Massey & Wheeler, 2000	MBD across activities	1 male; 4 years; low	Teacher: Most to least prompts, visual schedule	5	Classroom behavior: task engagement	.54 [.24, .84]	Weak
McCurdy & Cole, 2014	MBD across participants	3 males; 8, 7, and 11 years; high	Researcher, peers: PMI, prompting, reinforcement, performance feedback	6	Classroom behavior: on task behavior	.96 [.62, 1]	Adequate
McGee & Daly, 2007	MBD across participants	3 males; 4 and 5 years; high, moderate	Researcher: Incidental teaching, modeling, prompting, reinforcement	3	Social communication skills: social phrases	.71 [.49, .92]	Adequate

Table 1. Cont.

Morrison et al., 2002	MBD across participants	2 males, 2 females; 3, 4, 5 years; moderate	Researcher: Correspondence training, visual schedules, prompting, reinforcement	5	Play skills: on task play, play correspondence,	.90 [.65, 1]	Adequate
Nelson et al., 2007	MBD across participants and settings	4 males; 3 and 4 years; high, moderate, low	Researcher: Visual scripts, prompting, reinforcement	4	Social communication skills: initiations	.58 [.30, .85]	Adequate
Owen-DeSchryver et al., 2008	MBD across participants	3 males; 7 and 10 years; high, moderate	Researcher, peers: PMI, visual supports	4	Social communication skills: initiations, responses	.64 [.38, .89]	Adequate
Polychronis et al., 2004	Alternating treatment	2 males; 7 and 11 years; moderate	Teacher: Embedded instruction	6	Academic skills: identification of state capitals, telling time, number of trials to criterion	1 [.52, 1]	Adequate
Reeves et al., 2013	MBD across participants	3 males; 7 years; high	Teacher: FBA, task analysis, function based intervention	6	Classroom behavior: on task behavior	.80 [.51, 1]	Adequate
Roeyers, 1996	Group comparison	58 males, 27 females; 5-13 years; low, moderate, high	Researcher, peers: PMI	4	Social communication skills:		Adequate
					Intervals spent in interaction	1.08 [.70, 1.46]	
					Non interaction time spent in prosocial behavior	.97 [.59, 1.34]	
					Responses to initiations	1.61 [1.20, 2.01]	
					Positive responses to initiations	1.45 [1.06, 1.85]	
					Continuing initiations	.49 [.14, .85]	
					Number of initiations and responses per uninterrupted interaction	.36 [.0032, .72]	

Table 1. Cont.

Sainato et al., 2015	Group comparison	62 kindergarteners, gender NS; low, moderate, high	Teacher: Visual supports, naturalistic instruction, prompting, reinforcement, self-monitoring, PMI, direct instruction	4	Social communication skills, academic skills, classroom behavior:		Adequate
					Leiter- R	.59 [.03, 1.14]	
					KTEA - II	.41 [-.14, .10]	
					Oral language comprehension	.58 [.03, 1.14]	
					Oral expression	.58 [.02, 1.13]	
					Oral language listening comprehension	.51 [-.04, 1.07]	
					TOLD - P3	.46 [-.09, 1.01]	
					VABS	.37 [-.18, .92]	
Sansosti & Powell-Smith, 2008	MBD across participants	3 males; 6, 8, and 9 years; high	Teacher: Social Story, video modeling, prompts	7	Social communication skills: joining in, maintaining conversation	.82 [.54, 1]	Adequate
Scattone et al., 2006	MBD across participants	2 males; 8 and 13 years; high	Teacher: Social Story	5	Social communication skills: interaction	.67 [.37, .98]	Adequate
Schmidt & Stichter, 2012	ABCDCD across participants and settings	3 males; 12 and 13 years; moderate, high	Researcher, peers: Cognitive behavioral therapy, PMI	2	Social communication skills: initiations, responses, continuations	.50 [.35, .65]	Adequate
Schneider & Goldstein, 2009	MBD across participants	3 males; 5, 6, and 10 years; fxn NS	Researcher: Social Story, visual schedules	3	Classroom behavior: on task behavior	.66 [.45, .88]	Weak
Strain & Bovey, 2011	Group comparison	294 preschoolers; gender NS; low, moderate, high	Teacher: Full replication of LEAP early intervention model	6	Social communication skills, challenging behavior, academic skills:		Adequate
					CARS	.42 [-.97, .13]	
					PLS-4	.95 [.37, 1.53]	
					Mullen - ELC	.87 [.29, 1.44]	
					Mullen - Visual reception	.55 [-.01, 1.12]	
					Mullen - Fine motor	.69 [.12, 1.26]	
					Mullen - Receptive Language	1.01 [.51, 1.69]	
					Mullen - Expressive Language	.50 [-.06, 1.06]	

Table 1. Cont.

					SSRS – Positive	.76 [.19, 1.34]	
					SSRS - Negative	1.78 [1.13, 2.43]	
Strain et al., 2011	MBD across participants	2 males, 1 female: 5, 8, and 9 years; moderate, high	Teacher: FBA, direct instruction, reinforcement of replacement behaviors	5	Challenging behavior: aggression, elopement, disruptive behavior	.97 [.54, 1]	Adequate
					Classroom behavior: task engagement	.98 [.53, 1]	
Zanolli et al., 1996 Pre k	MBD across activities	2 males; 4 years; moderate	Teacher, peers: priming, PMI	5	Social communication: initiations	.88 [.67, 1]	Adequate

Effect sizes of .20 and lower are considered small, values from .21 to .79 moderate, and values at or above .80 large.

Key: MBD, multiple baseline design; FXN, functioning level; PMI, peer-mediated instruction; FA, functional analysis; FCT, functional communication training; FBA, functional behavioral assessment; RRB, restricted and repetitive behaviors; CI, confidence interval; ES, effect size

Table 2. Effect size calculations for study variables

Mean overall effectiveness (and standard deviation) of interventions for students with autism in inclusive settings by skill domain, participant functioning level, intervention delivery, and strength of research report, and social validity indicators.

Study variables	Number of studies	Number of participants	M SCD ES	M Group design ES
Skill domain				
Social communication skills	45	817	.77 (.26)	.70 (.37)
Restricted & repetitive behavior	2	2	.49 (.71)	NA
Play skills	6	17	.91 (.09)	NA
Challenging behavior	8	366	.88 (.15)	.92 (.74)
Academic skills	6	404	.61 (.68)	.67 (.25)
Classroom behavior	16	136	.81 (.19)	.61 (.21)
Participant fxn level				
High	42	179	.81 (.21)	results not disaggregated
Moderate	25	57	.81 (.20)	results not disaggregated
Low	13	25	.68 (.41)	results not disaggregated
Participant age				
Preschool (≈ 3 - 5 years)	18	389	.80 (.16)	.85 (.32)
Elementary (≈ 6 - 12 years)	33	431	.80 (.26)	.65 (.38)
Secondary (≈ 13 - 21 years)	11	37	.81 (.29)	NA
Intervention agent				
Teacher	23	469	.87 (.16)	.76 (.33)
Researcher	16	235	.78 (.22)	.46 (.09)
Teacher and peers	8	20	.66 (.47)	NA
Researcher and peers	12	122	.85 (.17)	.75 (.48)
Social Validity Indicators				
6 - 7 indicators	20	353	.91 (.15)	.83 (.40)
4 - 5 indicators	28	415	.82 (.20)	.75 (.37)
< 4 indicators	14	89	.57 (.37)	.46 (.27)

RESULTS

Participant characteristics

A total of 62 studies met the inclusion criteria for this meta-analysis. Fifty-five studies utilized single case research designs and 7 studies used group comparison research designs. Table 1 provides summaries and results for each study.

Eight hundred and fifty-seven participants with ASD in inclusive school settings were included. Although two studies did not specify the number of male to female participants (Sainato et al., 2015; Strain & Bovey, 2011), the vast majority of all participants in the included studies were male. Most participants (n = 431; 50%) were elementary school age (i.e., approximately 6 – 12 years old), followed by preschool age participants approximately 3 to 5 years old (n = 389; 45%), and secondary school age participants approximately 13 to 21 years old (n = 37; 5%).

Participant diagnoses included autism, ASD, Asperger syndrome, PDD-NOS, and comorbid diagnoses of ASD with intellectual disability, specific learning disability, attention deficit hyperactivity disorder, hearing impairment, visual impairment, cerebral palsy, intermittent explosive disorder, or dyslexia. Of the 81 studies reporting functioning levels for each participant, 42 studies included higher functioning participants (n = 179), 25 studies included moderate functioning participants (n = 57), and thirteen studies included lower functioning participants (n = 25). Two studies indicated that participants (n = 356) had lower, moderate, and higher functioning levels but did not specify the exact number of participants within each level of functioning (Sainato et al., 2015; Strain & Bovey, 2011). Similarly, two studies indicated participants (n = 222) with moderate and higher functioning levels but did not specify totals for each level (Kasari et al., 2016; Roeyers, 1996). Three studies with 28 participants total did not provide information on functioning levels (Kretzmann et al., 2014; Levingston et al., 2009; Schneider & Goldstein, 2009).

Intervention agents and strategies

Teachers or school staff delivered interventions to participants (n = 469) in 23 of the included studies (37%). Researchers delivered intervention to participants (n = 235) in 16 studies (26%). Teachers and typically developing peers delivered interventions to participants (n = 20) in 8 studies (13%). Researchers and typically developing peers delivered interventions to participants (n = 122) in 12 studies (19%). Three studies (5%) did not specify the intervention agent.

Several different intervention strategies and combinations of strategies with varying components and procedures were employed. The most commonly utilized interventions across the majority of studies include behavioral strategies (e.g., prompting, modeling, reinforcement, self-monitoring), peer-mediated strategies (i.e., interventions in which peers acted as the delivery agent), and visual strategies (e.g., visual schedules, Social Stories, script training, communication books).

Social validity

Fifty-one studies (82%) demonstrated adequate social validity. The social validity indicators demonstrated usually included a socially important dependent variable, clinically significant results, an intervention agent that typically interacts with the participant, and an intervention that occurs within the participant's natural context. Among the other social validity indicators, twenty-seven studies (43%) indicated a time and cost effective intervention and consumer satisfaction with results, and nineteen studies (30%) made comparisons between students with ASD and students without disabilities. Eleven studies (18%) did not include a sufficient number of social validity indicators.

Skill domain and target behaviors

Forty-five studies (73%) with 817 participants used interventions to target various social communication skills. These target behaviors commonly included peer interactions, initiations, responses, and social engagement. Several studies targeted social communication skills within the context of play, but only six studies (10%) with 17 participants specifically measured play skill behaviors. Sixteen studies (26%) with 136 participants targeted adaptive classroom behaviors, which included outcomes such as task engagement, hand raising, appropriate sitting, and attending to teacher. Eight studies (13%) with 366 participants targeted challenging behavior with measures commonly including aggression, elopement, disruption, and self-injury. Six studies (10%) with 404 participants targeted cognitive ability and skills necessary for success in academic areas. Two studies (3%) with two participants targeted restricted and repetitive behavior. Fifteen studies (24%) with 420 participants included outcomes from multiple skill domains (e.g., both social communication skills and academic skills).

Strength of Research

Each study was rated according to the presence or absence of all primary and secondary quality indicators. Eleven studies (18%) were classified as presenting strong research rigor, indicating high confidence in findings. Studies rated as strong received high marks on all primary quality indicators and provided sufficient evidence of secondary quality indicators (i.e., at least four indicators for group research and at least three indicators for single case research). Forty-two studies (67%) were classified as presenting adequate strength of research, indicating moderate confidence in findings.

These studies received high scores on a majority of primary quality indicators and presented evidence of at least two secondary indicators. Nine studies (15%) were classified as presenting weak strength of research, indicating low confidence in findings. These studies received fewer than four high quality ratings on primary indicators and showed evidence of less than two secondary indicators.

Effect sizes

Effect sizes for individual studies are presented in Table 1. Thirty-six studies (58%) demonstrated large treatment effects (i.e., at or above .80) on all outcomes. Seventeen studies (27%) demonstrated moderate effects (i.e., .21 - .79) on all outcomes. Five studies (8%) indicated treatment effects ranging from moderate to large. Two studies (3%) indicated small effects (i.e., .20 and lower). Two studies (3%) indicated small to moderate effects.

Mean effect sizes across different study variables are presented in Table 2. Interventions to reduce challenging behavior utilized in single-case design studies reported large effects (M = .88), as did interventions measuring challenging behavior within group design studies (M = .92). Interventions targeting social communication skills indicated moderate effects for both single-case design (M = .77) and group studies (M = .70). Interventions targeting academic outcomes also produced moderate effects (SCD M = .61; group design M = .67). Interventions targeting adaptive skills necessary for appropriate classroom behavior indicated large effects for single-case design studies (M = .81) and moderate effects for group design studies (M = .61). Only single case design studies measured the effects of interventions on play skills and restricted and

repetitive behavior, and these effects were large and moderate, respectively (M = .91; M = .49).

Group design studies did not disaggregate results according to different levels of participant functioning, and given the data available, it was not possible to provide these calculations for these studies. In single case design studies, interventions for higher and moderate functioning participants yielded large effects (M = .81), and moderate effects (M = .68) were reported for lower functioning participants.

Interventions involving preschool age participants indicated large overall effects (SCD M = .80; group design M = .85). Interventions for elementary school age participants indicated large effects within single case design studies (M = .80) and moderate effects within group design studies (M = .65). Interventions for secondary school age participants indicated large overall effects (SCD M = .81).

Within single case design studies, teachers delivering interventions yielded large overall effects (M = .87) and researchers yielded moderate effects (M = .78). Within group design studies, both teachers and researchers as intervention agents resulted in moderate overall effects (M = .76; M = .46). Teachers and peers delivering interventions resulted in moderate effects (SCD M = .66). Researchers and peers delivering interventions in single design studies resulted in large overall effects (M = .85), and researchers and peers delivering interventions within group design studies produced moderate effects (M = .75).

Both single case design and group design studies that demonstrated six to seven social validity indicators reported large overall effects (M = .91; M = .83). Studies that

demonstrated four to five social validity indicators produced large to moderate effects (SCD M = .82; group design M = .75). Studies demonstrating three or fewer social validity indicators produced moderate effects (SCD M = .57; group design M = .46).

DISCUSSION

This meta-analysis is the first comprehensive work to quantitatively analyze the effectiveness of interventions for students with ASD in inclusive classroom settings. Results suggest that these interventions have generally produced moderate to large effects across skill domains, with the majority of interventions found to be socially valid in this setting. That a majority of studies (n = 53) received strong or adequate strength of research report ratings points to a high level of certainty with respect to the evidence supporting the claims of positive outcomes. Most of the included studies (n = 45; 73%) targeted social communication skills, involved predominantly higher functioning participants (n = 42; 68%), and reported overall moderate outcomes (Tau-U = .77; Cohen's d = .76). Participant functioning level and the number of social validity indicators included in the studies appeared to influence outcomes, while other study variables (i.e., participant age, intervention agent) did not appear to greatly influence intervention effectiveness.

Because intervention procedures varied considerably across studies, recommending a specific strategy for practitioner use is rather tenuous. However, the majority of studies included prompting, modeling, and reinforcement, peer-mediated strategies, and/or visual cues and supports, and such strategies have been identified as evidence-based practices for individuals with ASD within the broader literature (Wong et

al., 2013). Based on the results of this meta-analysis, these interventions produced overall effective results for students with ASD in inclusive classrooms and should be considered recommended strategies for practitioners in this setting. Given the heterogeneous nature of ASD, these interventions would seem to offer teachers in inclusive classrooms customizable treatment options for students with diverse needs and characteristics (Odom et al., 2012; Stahmer et al., 2011; Watkins et al., 2017).

Teachers implemented interventions or trained peers to deliver interventions to classmates with ASD in roughly half of the included studies, with generally large to moderate effects. These results are encouraging and demonstrate that teachers in inclusive classrooms are able to implement interventions for students with ASD that are both effective and socially valid. Given that general education teachers typically do not have training in or knowledge of research-based interventions for students with ASD (Pazey et al., 2014; Segall & Campbell, 2012), it would be prudent for teacher preparation programs and school administrations to provide the necessary resources and training that will allow teachers in inclusive settings to successfully address these students' needs. As the number of students with ASD included in general education settings continues to grow, general education teachers must be equipped to implement evidence-based strategies for these students and are indeed required to do so under IDEA regulations.

In addition to these recommendations for practice, there are several evident directions for future research based on the findings of this meta-analysis. That most interventions targeted social communication skills is unsurprising as social

communication impairments are present in individuals with ASD regardless of cognitive or language ability and are often cited as top treatment concerns for these students (Lang et al., 2010; Levy & Perry, 2011; Pituch et al., 2011). However, studies targeting social communication outcomes produced overall moderate results, which indicate that treatment effects are not as robust as would be desired. This finding is similar to that of other syntheses examining outcomes of social communication interventions for school children with ASD (e.g., Bellini et al., 2007). In order to strengthen outcomes, the literature has provided several recommendations to improve the effectiveness of social skills interventions including increasing intervention dosage, aligning the intervention strategy to the type of deficit demonstrated by the participant, and ensuring rigorous intervention fidelity (Bellini et al., 2007; Gresham et al., 2001; Quinn et al., 1999; Watkins et al., 2015).

As improved social communication skills may result in collateral gains in domains not directly targeted by the intervention (Ledbetter-Cho et al., in review), it would also seem prudent for researchers targeting social communication skills to directly assess whether such interventions produce improvement in other areas (e.g., play skills, restricted and repetitive behaviors, challenging behavior). For example, Kasari et al (2012) found that a peer-mediated intervention targeting social communication skills resulted in a collateral decrease in the participants' challenging behavior. Similarly, Blair et al (2007) found that improved social communication skills led to collateral decreases in challenging behavior and an increase in appropriate classroom behaviors such as task engagement. Interventions that potentially produce multiple desirable outcomes may

increase the impetus for teachers in general education settings to employ these strategies.

That few studies assessed outcomes for restricted and repetitive behavior, play skills, challenging behavior, and academic skills in inclusive settings is cause for concern. Deficits in play skills and the presence of restricted and repetitive behaviors or interests are both defining features of ASD (APA, 2013), and it would seem likely that interventions for these behaviors would be necessary for students with ASD in inclusive settings. Similarly, challenging behavior is prevalent in children with ASD and is often considered an associated feature of the disorder (Matson & Nebel-Schwalm, 2007), yet scant research focusing on interventions to treat challenging behavior in students with ASD in inclusive classrooms exists. Challenging behavior has been shown to be a barrier to successful inclusion (Dunlap et al, 2010; Crosland & Dunlap, 2010; Emerson et al., 2001), so it would be prudent for future research to more thoroughly assess which strategies are effective in reducing challenging behavior and are feasible to implement in inclusive classrooms. Finally, given the emphasis that most schools place on academic achievement for students in general education, it is necessary to develop effective instructional strategies for students with ASD. Many of these students experience difficulties with academic functioning, and research has shown that teachers struggle with identifying and implementing academic interventions for this population (Whitby & Mancil, 2009); thus, there is a great need for research-based intervention strategies that will help improve academic outcomes for students with ASD.

Future research should also strive to include participants with a broader range of characteristics. Few studies (n = 11) included secondary school age participants, which is

reflective of ASD research in general as adolescents are underrepresented compared to research involving younger children (Schall & McDonough, 2010). Encouragingly, age did not appear to moderate intervention effectiveness, with overall intervention results for this subset comparable to those of elementary and preschool age students. As the prevalence of ASD continues to increase and growing numbers of these children reach adolescence, research with this population is vital and future studies that include greater numbers of secondary school age participants is needed.

Similarly, among the 62 included studies, only 13 included participants with lower levels of functioning. Although lower functioning students with ASD may not be as likely to be included in general education settings compared to students with less severe symptomology (Walton & Ingersoll, 2013), the increase in inclusive educational practices for individuals with ASD of all ability levels potentially increases the opportunities for inclusion for this subset. Considering that nearly 60% of all students with ASD spend at least 40% or more of their school day in general education settings with typically developing peers (U.S. Department of Education 2015), researchers should endeavor to include participants with ASD across the spectrum in future studies.

Though the sample size for this subset of the population included in this meta-analysis was relatively small, results indicated that interventions for lower functioning students produced overall moderate effects, compared to large effects for moderate and higher functioning participants. This is perhaps indicative of a mismatch between the intervention strategy employed and the type of deficit exhibited by lower functioning students with ASD. The distinction between interventions targeting skill deficits (i.e.,

lack of ability) versus performance deficits (i.e., lack of motivation) was little addressed in the included studies, and this distinction is necessary in order to select interventions that will result in either skill acquisition or enhancement of existing skills (Bellini, 2006).

A primary aim of this meta-analysis was to assess the social validity of interventions for students with ASD in inclusive settings. Interestingly, studies that demonstrated the greatest number of social validity indicators produced the strongest overall intervention effects. Rather than only assessing social validity post intervention (e.g., practitioner satisfaction with intervention results), researchers should consider directly programming for more rigorous measures of social validity when developing interventions for students with ASD in inclusive classrooms. Although the mechanism by which these studies produced the largest effects is unclear, interventions that practitioners in these settings consider time and cost effective, target outcomes appropriate to the inclusive classroom setting, and provide measures of comparison to typically developing students may increase teacher "buy in" and their willingness to implement intervention procedures with fidelity. That is, teachers may be more likely to adopt interventions that contain these components and carry them out as designed (Kennedy, 2002; Kucharcyzk, 2015; Lang & Page, 2011; Pazey et al., 2014).

The findings of this meta-analysis provide recommendations for both practice and research, yet results should be judiciously considered due to the following limitations. Although Tau-U and Cohen's d have precedence for use in meta-analyses containing single subject and group design studies (e.g., Bowman-Perrott et al., 2013), these measures are not directly analogous and any comparisons should be considered as

approximations only. It is also important to interpret results in relation to the established confidence intervals for each outcome. For example, a study reporting a moderate effect with a relatively narrow confidence interval may produce results similar to a study reporting a large effect with a wider confidence interval. In addition, group design studies often did not disaggregate results according to different participant characteristic (e.g., level of functioning), so these data could not be included in overall findings. Results regarding certain study variables that included relatively small sample sizes (e.g., interventions targeting restricted and repetitive behavior or secondary school age participants) should be interpreted especially cautiously as the number of studies could influence overall effect sizes. Further, the variability of intervention procedures utilized across the included studies, as well as the unique combinations of multiple interventions to create treatment packages, precluded a closer analysis of effectiveness according to specific intervention types. Finally, as is the case with most meta-analyses, there is a potential for publication bias that could possibly lead to inflated results regarding the effectiveness of an intervention by excluding results of unpublished studies not reporting positive outcomes (Ganz et al., 2012; Scargle, 2000).

Overall, the results of this meta-analysis indicate that interventions for students with ASD in inclusive settings have produced mostly moderate to large effects and have demonstrated sufficient social validity which should further support the use of these interventions in general education classrooms. There is an obvious need to develop interventions that target domains beyond just social communication skills, and interventions that effect positive change in play skills, restricted and repetitive behavior,

challenging behavior, and academic skills is needed, as is the inclusion of participants with a broader range of characteristics, notably students with ASD that are moderate to lower functioning and are secondary school age. Beyond comprehensive early intervention treatment packages for preschool age participants (e.g., Eldevik et al., 2012; Strain & Bovey, 2011), there are presently no rigorously designed large-scale studies that assess interventions for students with ASD in inclusive settings and target outcomes across a variety of domains. In order to improve long-tem outcomes for individuals with ASD during their school years and beyond, this would seem an evident and needed next step in this field of research.

CHAPTER 3: Method

The purpose of this chapter is to describe the methodology of this study, which consisted of two related experiments. The purpose of each experiment is described, followed participants characteristics and the setting and materials utilized in the study. Operational definitions of dependent and independent variables are described, and the research design, data collection procedures, methods for calculating interobserver agreement, procedural fidelity, and assessments of social validity are detailed.

EXPERIMENT 1

The purpose of this study was to extend previous research (e.g., Boyd et al., 2006; Koegel et al., 2012a, 2012b, 2013) by incorporating the preferred interests of young children with ASD into play activities that were also appealing to typically developing classmates within the context of an inclusive classroom setting. Specifically, in this experiment I sought to assess if a.) the incorporation of preferred interests would increase peer interaction for a variety of participant profiles, ranging from high to low functioning ASD diagnoses; b.) intervention results would generalize to novel peers and maintain following the intervention; and c.) the results of the intervention would be found socially valid in an inclusive classroom environment.

PARTICIPANTS

Four children with a diagnosis of ASD (hereafter referred to as participants) and four typically developing children (hereafter referred to as peers) participated in the study. English was the primary home and school language of all participants and peers. Participants were diagnosed with ASD by an independent qualified expert (e.g.,

developmental pediatrician or neurologist) prior to this study. All participants received special education services and had social-communication related individual educational plan (IEP) goals, but they had not received an intervention specifically targeting social interaction with their peers. Teacher report and researcher observation indicated that participants interacted infrequently with peers during free play activities.

Typically developing peers were chosen based recommendation in the literature including age appropriate verbal and social skills, a history of compliance with teacher directions and of offering to help classmates, and were paired with participants based upon teacher and support staff recommendation (Odom & Strain, 1984; Harper et al., 2008; Watkins et al., 2015). At the time of the study, no typically developing male students were enrolled in the classroom, so same gender pairings were not possible for all participants. Typical peer partners were four girls ranging in age from 46 to 62 months.

Arjun was a South Asian American male and was 65 months at the start of the study. He scored a 30.5 on the Childhood Autism Rating Scale, second edition (CARS-2; Schopler et al., 2010) indicating mild-to-moderate symptoms of ASD. Arjun had well developed verbal skills, spoke in complete sentences of 4 - 6 words, and demonstrated functional play skills. He initiated interaction frequently with adults, but his interactions with peers consisted primarily of responses to their initiations. Arjun occasionally engaged in stereotyped motor behaviors including hand flapping and bouncing up and down while seated.

Emmett was a White American male and was 54 months at the start of the study. He scored a 32.5 on the CARS-2, indicating mild-to-moderate symptoms of ASD.

Emmett had limited verbal communication skills and could make requests to adults using two to three word phrases (e.g., “chase me!”). He sought out adult attention regularly but interacted infrequently with peers. Emmett’s play tended to be solitary, and his language during play was often imitative and echoic (e.g., reciting scripted phrases from his favorite movies).

Austin was a White American male and was 57 months at the start of the study. He scored a 45 on the CARS-2, indicating severe symptoms of ASD. Austin had limited verbal communication skills and rarely exhibited meaningful speech. In response to a teacher asking what he wanted, Austin could verbally approximate a one-word response (e.g., “car” or “block”). He demonstrated restricted patterns of behavior involving objects (i.e., repetitively organizing, lining up, rotating and sorting small items) and body movement (i.e., rotating his hand in front of his face, kicking legs and waving arms). He primarily used toys to engage in stereotypy.

Julia was a Chinese Mexican American female and was 74 months at the start of the study. She scored a 50 on the CARS-2, indicating severe symptoms of ASD. She did not demonstrate functional verbal speech. Julia rarely initiated to adults or peers, and she responded to initiations from adults after prompting. For example, when prompted by her teacher, she could utilize picture symbols to make requests (e.g., watch a video). During playtime, Julia engaged in solitary or restrictive and repetitive behaviors. She often engaged with toys and objects by exploring their sensory features.

Members of the research team served as facilitators during play sessions. They did not serve other roles at the school. Appropriate institutional board approval and informed consent was obtained for the study.

SETTING AND MATERIALS

Sessions were conducted in a private community school for students with disabilities that offered an inclusive early childhood preschool setting. The inclusive preschool classroom served both typically developing students and students with disabilities. The class had five students with developmental disabilities, six typically developing peers, one head teacher, and two assistant teachers. The room was approximately 17.5' x 20'. The front half of the room contained a round table and a rectangular table for group and seatwork, as well as a sensory table filled with sand. The back half of the room consisted of a play area delineated by a rug surrounded with shelves of toys and a reading area delineated by another rug surrounded by cushions and pillows. All baseline and intervention sessions with each participant and peer dyad took place within the play area of the classroom. The teacher, assistants, and other students were in close proximity with the participant and peer dyad during all sessions but were engaged in other activities within the classroom (e.g., one to one teaching, small group work, free play). Students rotated between these different activities, including playtime, during the course of the morning.

DEPENDENT VARIABLES

Primary dependent variables included frequency of social interactions between a participant and typically developing peer during a play session. Each participant's

interaction was further categorized as either an initiation directed to a peer, or a response directed to a peer's initiation.

Dependent variables included frequency of overall social interactions between a participant and a typically developing peer during a play session; these interactions were further categorized into appropriate initiations directed to a peer and appropriate responses directed to peer initiations. Appropriate social initiations were operationally defined as any verbal, nonverbal, or motor behaviors directed toward a typically developing peer to evoke a response, such as greetings, asking questions, commenting, sharing materials, or helping behaviors (Tsao & Odom, 2006). Examples of appropriate social initiations included verbal phrases such as "let's play" or "your turn", nonverbal behaviors such as tapping a peer and then pointing toward a toy, and motor behaviors such as handing a peer a toy to play with. A smile or a look did not qualify as an initiation if there was no additional verbal or physical contact. Appropriate social responses were defined as a reply within 5 seconds to an initiation made by a typically developing peer, such as looking when their name was called, following a peer's direction or request, answering a peer's question, accepting materials given by the peer, or head nodding after a peer's comment (Tsao & Odom, 2006).

Each appropriate social interaction behavior could be recorded as either an initiation or response and were mutually exclusive. Negative interactions such as disruptive verbal or motor behavior (i.e., hitting, pushing, kicking, or biting clearly directed toward a peer) were reported by classroom staff and observed by the authors as not being typical of these participants and were therefore not coded.

The secondary dependent variable was the duration of interactive play during play sessions. Interactive play was defined as the child being engaged in a play activity (e.g., pushing a toy truck, playing a game, using art materials) within approximately 2 m of his/her peer and interacting either verbally (e.g., commenting to the peer, asking questions, giving directions) or nonverbally (e.g., taking turns, looking at the peer when the peer is talking, following the peer's direction or request, sharing play materials; cf. Hundert et al., 1998; 2014).

DATA COLLECTION AND ANALYSIS

During each session the total number of social interactions, with initiations and responses indicated, were recorded in vivo and subsequently graphed. Probes for the duration of interactive play were conducted from recorded sessions across all phases, and the data were subsequently graphed. Visual analysis was conducted following recommendations provided by Kennedy (2005) and based upon differences in level, trend, and variability between baseline and intervention phases in order to determine the existence of a functional relation.

Tau-U, a nonparametric effect size measures suitable for single-case research designs, was calculated in order to provide statistical analysis of intervention results. Tau-U measures the amount of overlap between two phases and is well suited to small data sets typical to single-case design research. As Tau-U follows the "S" sampling distribution, p-values and confidence intervals are available. In addition, Tau-U also controls for positive data trend (monotonic trend) in the baseline phase (Parker et al., 2010). For Tau-U, effect sizes of .20 and lower are considered small, values from .21 to

.79 moderate, and values at or above .80 large. Statistical significance was determined by calculating *p* values and confidence interval CI_{95}. A web-based tool was used to calculate effect sizes (Vannest et al., 2011).

EXPERIMENTAL DESIGN

A multiple baseline across participants with an embedded ABAB design was used to evaluate the effects of the preferred activity intervention on participants' overall levels of interactions, initiations, and responses (Kennedy, 2005). Conditions included baseline, preferred play activity, generalization, and maintenance.

BASELINE

Baseline sessions were 10 minutes in length and consisted of business as usual free play in the classroom. The facilitator directed the participant and peer dyad to the play area of the classroom and told them "it's time to play". The participant and peer were allowed to select any of the toys that were available on the shelves surrounding the play area or to select other items within the classroom and bring them to the play area rug. Items available during baseline play sessions included blocks, puzzles, kitchen and cooking toys, animal and people figurines, stuffed animals, Mr. Potato Head®, board games, dolls, a doll house, a farm play set, a police play set, a fire station play set, counters differing in color and size, collared pencils and paper, and paint stampers. The children were given no social skills instruction and no prompting or reinforcement was provided for any social interaction behaviors exhibited by either the participant or peer. If the participant or peer left the play area, the facilitator directed the child back to the play area for the remainder of the session. When the 10 minute session was complete, the

adult facilitator announced that play time was over and instructed the children to rotate to a new activity within the classroom.

INTERVENTION

An age appropriate play-based activity mutually appealing to the typically developing peers was designed around each participant's circumscribed or preferred interest. I interviewed the classroom teacher, parents, and other school staff in order to determine which activities the participants most frequently engaged in (Koegel et al., 2012a, 2012b, 2013). Of the identified preferred activities based on researcher observation and teacher and parent report, I then selected those activities that would also be appealing to typically developing peers. For example, Julia was observed and reported to frequently play segments of Disney songs repeatedly on an iPad®. She was also observed and reported to frequently draw and scribble with markers, pens, or colored pencils in a notebook. Of these activities, it was determined that coloring and drawing would be more appealing to a typically developing peer. After mutually appealing preferred interests were identified for each participant, individualized play activities were then developed. Each play activity utilized materials and items typically found in an early childhood education setting and did not require the development of novel or specialized materials. The preferred play activities are described below.

Arjun frequently played with transportation related toys (e.g., cars, trucks, trains, train tracks, road signs), and all his play activities were centered around this theme. These activities included making roads out of tape and driving different vehicles over them, directing traffic using street signs, building railroad tracks, playing "red light, green

light" with toy cars, and using car play sets. Emmett often played with Lego® and frequently watched the Lego® movie, and all his activities used these items. These activities included matching games with Lego® characters; building towers, castles, robots, etc. using over-sized Lego® blocks; and gross motor activities incorporating Lego® figures (e.g., hitting a balloon back and forth using a paddle he and his peer decorated with Lego® characters). Austin exhibited repetitive behaviors that involved lining up items by shape, size, or color. His preferred activities that were also appealing to his peers were games that utilized these visual spatial strengths and included games such as Connect Four®, Kerplunk®, and stacking wooden beads of different shapes and colors on a pole to create a variety of patterns. Julia frequently colored and used various art materials during the school day, and all of her activities involved this skill. These activities included craft activities, coloring paper dolls featuring popular storybook characters, and creating collages using markers, crayons, glitter, and stickers. The different activities based on the participants' preferred interest were rotated across sessions.

The intervention was introduced sequentially across participants so that Arjun received the intervention first, followed by Emmett, then Austin, and then Julia. Each intervention session lasted for ten minutes. As in baseline, the participant and peer were directed to the play area of the classroom. The facilitator was responsible for the organization of the materials and providing a brief introduction of the preferred play activity to the participant and peer through modeling and verbal explanation that lasted approximately two to three minutes. Adult modeling and verbal explanation of an activity

was provided only upon the first introduction of a new play activity. For example, the first time Arjun and his peer partner played "red light, green light" with toy cars, this activity was modeled. Upon subsequent sessions of this game, the facilitator announced the activity but modeling and explanation were not provided. After the activity was introduced, the facilitator moved away from the play rug and did not intervene or direct the activity during the ten-minute play session. If requested, the facilitator was available to clarify instructions or answer questions posed by the participant or peer as it pertained to the activity, and announce the next step of an activity, if necessary (Koegel et al., 2012a, 2012b, 2013). For example, during activities based around arts and crafts, the facilitator could remind the child what to do next to complete the craft if asked. The facilitator did not provide any prompts or reinforcement for social interaction or provide any social skills instruction or feedback to the participant or peer at any time before, during, or after the play session.

GENERALIZATION AND MAINTENANCE

Generalization was assessed throughout all phases of the study. Generalization sessions and procedures were identical to those in baseline and treatment phases but were conducted with novel peer partners. To assess the durability of the preferred activity intervention, maintenance probes were collected at six weeks following the conclusion of the intervention. Maintenance sessions were identical to those during treatment and were conducted both with the usual peer partner and with a novel generalization partner.

INTEROBSERVER AGREEMENT

Graduate students trained in behavioral interventions independently recorded data used to calculate interobserver agreement (IOA). IOA data for the primary dependent variables (i.e., frequency of social interactions) were recorded in vivo for 73% of sessions across all phases of the study. Interobserver agreement for social interactions, initiations, and responses was calculated using a total agreement approach (Kennedy, 2005). The total number of social interactions recorded by each observer was summed, the smaller total was divided by the larger total, and the amount was multiplied by 100%. Likewise, the total number of initiations and responses recorded by each observer was summed, the smaller total was divided by the larger total, and the amount was multiplied by 100%. Mean interobserver agreement for social interaction was 98.9% (range 84%-100%) across participants. Mean interobserver agreement for initiations was 96.9% (range 67%-100%) across participants. Mean interobserver agreement for responses was 98.5% (range 79%-100%) across participants. Data for the secondary dependent variable (e.g., duration of interactive play) was collected from recorded probe sessions across all phases of the study. Interobserver agreement for duration of interactive play was calculated using a total agreement approach (Kennedy, 2005). IOA data for the secondary dependent variable (i.e., duration of interactive play) were recorded for 48% of sessions across all phases of the study. The duration of interactive play recorded by each observer in a session was totaled, the smaller total was divided by the larger total, and the amount was multiplied by 100%. Mean interobserver agreement for duration of interactive play was 94% (range = 81% - 100%) across participants.

PROCEDURAL FIDELITY

Data collectors recorded procedural fidelity (i.e., the accuracy of the facilitators' implementation of the preferred activity intervention) for 86.5% of treatment sessions across all participants. A dichotomous check-list that included four essential components of treatment (i.e., facilitator introduces the appropriate preferred play activity; answers questions from the participant or peer only if it pertains to the activity; does not instruct, prompt, or reinforce social interaction behaviors between the participant and peer; and intervenes during the preferred play activity only if problem behavior from the participant or peer arises [e.g., hitting, pushing, name calling, crying, or other aggressive acts]). Problem behavior occurred infrequently throughout the study, and the facilitator intervened only in rare instances such as when Arjun grabbed a toy away from the peer, resulting in the peer crying. Procedural fidelity was determined by dividing the number of checklist items scored as correct by the total number of checklist items and multiplying by 100%. Procedural fidelity was 100% for all participants.

SOCIAL VALIDITY ASSESSMENT

Three types of social validation measures were used in this study including comparisons to typically developing peers, teacher evaluation of the feasibility of intervention, and ratings by unbiased observers of participant social behavior during baseline and intervention. The four typically developing peers in the study served to provide a normative range of peer interactions during free play sessions. Each typical peer was observed three times with another typical peer of their choosing (not the targeted peers with ASD) during ten-minute free play sessions. Overall frequency of social interactions was recorded, and the mean number and standard deviation of social

interactions per play session ($M = 22$, $SD = 11.8$) were used to estimate a normative range of social interaction. Dashed lines in Figure 1 indicate the normative range of typical peer interaction. Social interaction behaviors exhibited by typically developing peers were recorded in the same manner as the data for the participants with ASD.

Post intervention, the classroom teacher provided feedback regarding the acceptability and feasibility of the intervention. Specifically, the teacher answered questions regarding her ability to use the intervention strategy in the classroom without the assistance of researchers, how likely it was that she would incorporate this intervention into the typical classroom routine, whether she viewed this intervention as an effective way to increase social interaction between students, and if the participants were included more frequently in classroom activities following the completion of the intervention.

In order to determine the clinical significance of the behavior change, a convenience sample (Pedhazur & Schmelkin, 1991) of eighteen undergraduate pre-service teachers at a university was surveyed following the conclusion of the intervention. The pre-service teachers had taken foundational education courses, had general knowledge about disability matters, and had two semesters of teaching experience through internships in public schools. The ages of the pre-service teachers ranged from 20 and 25 ($M = 21$). The pre-service teachers viewed two-minute video clips that contained (a) a segment of the participant during a standard intervention session with the preferred activity incorporated during play time with a peer and (b) a segment of the participant during a control baseline session with a peer, without the preferred activity.

The segments were selected because the researchers considered them highly representative of the participants' performance within the two conditions (Lancioni et al., 2006). The order of the baseline and intervention segments was randomly assigned, and the pre-service teachers were not aware of the purpose of the intervention, nor was the disability of the participant disclosed. Using a five point Likert-type scale, raters answered questions regarding the participant's social interaction with the typical peer, the quality of the participant's play as compared to other children his age, and whether a teacher would find the interaction acceptable in the classroom. Mean and standard deviation were calculated for each item across all participants, and the mean scores across all items for each participant was provided. A nonparametric Wilcoxon signed-rank test was then used to examine the statistical significance of the difference in Likert scale ratings between baseline and intervention conditions for all participants.

Experiment 2

The purpose of this study was to investigate the effects of incorporating the preferred or restricted interests of a preschool student with ASD into play activities appealing to peers on stereotypy, functional play, and social engagement. This investigation was an expansion of Experiment 1, which examined the effects of this intervention on the social interaction between preschoolers with and without ASD. Specifically, as stereotypy may be more likely to occur in the absence of preferred activities (Kennedy et al., 2000), I hypothesized that stereotypical behavior will decrease when the participant's preferred or restricted interests are incorporated into play activities with a typically developing peer. In addition, I assessed whether embedding restricted

interests into structured play activities would also result in an increase in functional play skills with peers.

PARTICIPANT AND SETTING

Austin, a preschool student with ASD from Experiment 1 who demonstrated difficulties interacting with typically developing peers and additionally exhibited restricted patterns of behavior participated in this study. Austin rarely exhibited intelligible communicative speech and demonstrated restricted patterns of behavior involving objects (i.e., repetitively organizing, lining up, rotating, or sorting small items) and body movement (i.e., flapping his hand in front of his face, kicking legs and waving arms). Austin exhibited few functional play skills and used toys to engage in stereotypy. Results of the Questions About Behavioral Function survey (QABF; Matson & Vollmer, 1995) indicated that non social reinforcement was the maintaining variable for his stereotyped behaviors. A typically developing classmate who demonstrated age-appropriate verbal and social skills and had a history of compliance with teacher directions and of offering to help classmates served as the play partner. Two typically developing classmates served as generalization partners based on the same selection criteria.

As in Experiment 1, sessions were conducted in a private preschool classroom where one head and two assistant teachers provide educational services to five students with developmental disabilities and six typically developing peers.

DEPENDENT VARIABLES, DATA COLLECTION, AND ANALYSIS

Data were collected on the percentage of intervals within play sessions that Austin engaged in stereotypy and functional play. Stereotypy was defined as rapid and repetitive rotation of hand with or without materials (e.g., rotating a block in front of the face); kicking legs and swinging arms up and down while seated; vocalizations that are not recognizable words; and lining up toys or other items. As in previous research, functional play was defined as using play materials in a manner appropriate to their intended function; for example, rolling a toy car along the ground (c.f., Lang et al., 2009).

The percentage of intervals engaged in stereotypy and functional play was scored from videos of each 10-min session using 10-second partial interval recording. For each interval, the presence or absence of each dependent variable was recorded, and the percentage of intervals with presence of stereotypy and functional play was calculated for each session. Stereotypy and functional play were not mutually exclusive and could occur within the same interval.

Visual analysis was conducted following recommendations provided by Kennedy (2005) and based upon differences in level, trend, and variability between baseline and intervention phases in order to determine the existence of a functional relation. Tau-U was again calculated in order to provide statistical analysis of intervention results.

EXPERIMENTAL DESIGN

An ABAB design was used to evaluate the effects of the restricted interest based activity intervention on stereotypy and functional play (Barlow et al., 2008).

INTEROBSERVER AGREEMENT AND PROCEDURAL FIDELITY

I coded data for all sessions, and a member of the research team provided independent interobserver agreement for 32% of sessions. Reliability was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100%. Mean interobserver agreement was 91% (range = 86.8% - 98.4%) for stereotypy and 93.2% (range = 84.9% - 100%) for functional play. In terms of fidelity to intervention procedures, the presence or absence of the preferred interest play activity (independent variable) within each session was noted during data coding and fidelity of implementation was 100%.

BASELINE, INTERVENTION, GENERALIZATION, AND MAINTENANCE

These procedures were identical to those in Experiment 1.

SOCIAL VALIDITY ASSESSMENT

Post intervention, the classroom teacher provided feedback regarding the acceptability and feasibility of the intervention. The typically developing classmates also provided feedback on their enjoyment of the structured play activity that incorporated the participant's preferred and restricted interests.

CHAPTER 4: Results[1]

Experiment 1 Results

SOCIAL INTERACTION

Figure 2 depicts frequency of total social interactions (i.e., both initiations and responses) for each participant during each play session. Dashed lines indicate the range of typical peer interaction. During baseline, Arjun's number of peer interactions remained low after the initial session (M = 3.2, range = 0 - 9). Following the introduction of the transportation themed play activity, Arjun's number of peer interactions immediately increased to within the peer normative level, with an average of 18.7 peer interactions, ranging from 11 to 30 interactions per session. When the preferred activity intervention was withdrawn, Arjun's number of peer interactions again decreased to baseline levels (M = 3.3). Following the reimplementation of the preferred activity intervention, Arjun's number of peer social interactions again increased to well above baseline levels, with an average of 21.7 peer interactions, ranging from 16 to 31 interactions per session.

Emmett interacted with peers an average of 1.1 times in baseline sessions (range = 0 - 5). During the first preferred play activity intervention session, interaction remained at baseline levels, but the number of peer interactions increased the following session and remained stable and within the peer normative range throughout the intervention phase (M = 24.8, range = 0 - 48). With the removal of the preferred play activity, Emmett's

[1] The results in Experiment 2 have been published in: Watkins, L., O'Reilly, M., Kuhn, M., Lang, R., van der Burg, T., & Ledbetter-Cho, K. (2017). Incorporation of restricted interests reduces stereotypy and facilitates play and social engagement between a preschooler with autism and peers in inclusive setting. Advances in Neurodevelopmental Disorders, 1, 37-41. Watkins designed and implemented the study, performed all data collection and analysis, and wrote the manuscript. Kuhn, van der Burg, and Ledbetter-Cho conducted IOA. O'Reilly and Lang provided feedback on the manuscript.

number of interactions decreased to an average of 1.3 interactions per session. With the reimplementation of the preferred activity, Emmett's number of interactions with peers increased to an average of 29 interactions, ranging from 21 to 32 interactions per session.

Austin exhibited zero peer interactions during baseline sessions. After the introduction of games that potentially matched features of his stereotypy (e.g., Connect Four®), Austin's number of peer interactions steadily increased to within the peer normative range with an average of 14.6 interactions, ranging from 0 to 20 interactions per session. Following the removal of the preferred activity, Austin's number of peer interactions returned to zero. After the preferred activity was reintroduced, Austin's number of peer interactions immediately returned to the normative range, with an average of 15.2 peer interactions, ranging from 13 to 17 per session.

Julia exhibited zero interactions with peers during baseline. A modest increase in social interaction was recorded following the implementation of the preferred activity intervention with an average of 4.2 peer interactions, ranging from 3 to 6 interactions per session. With the withdrawal of the preferred activity, Julia's number of peer interactions again returned to zero. Following the reimplementation of the preferred activity, Julia's number of interactions increased to above baseline levels, with an average of 4 interactions, ranging from 2 to 6 interactions per session.

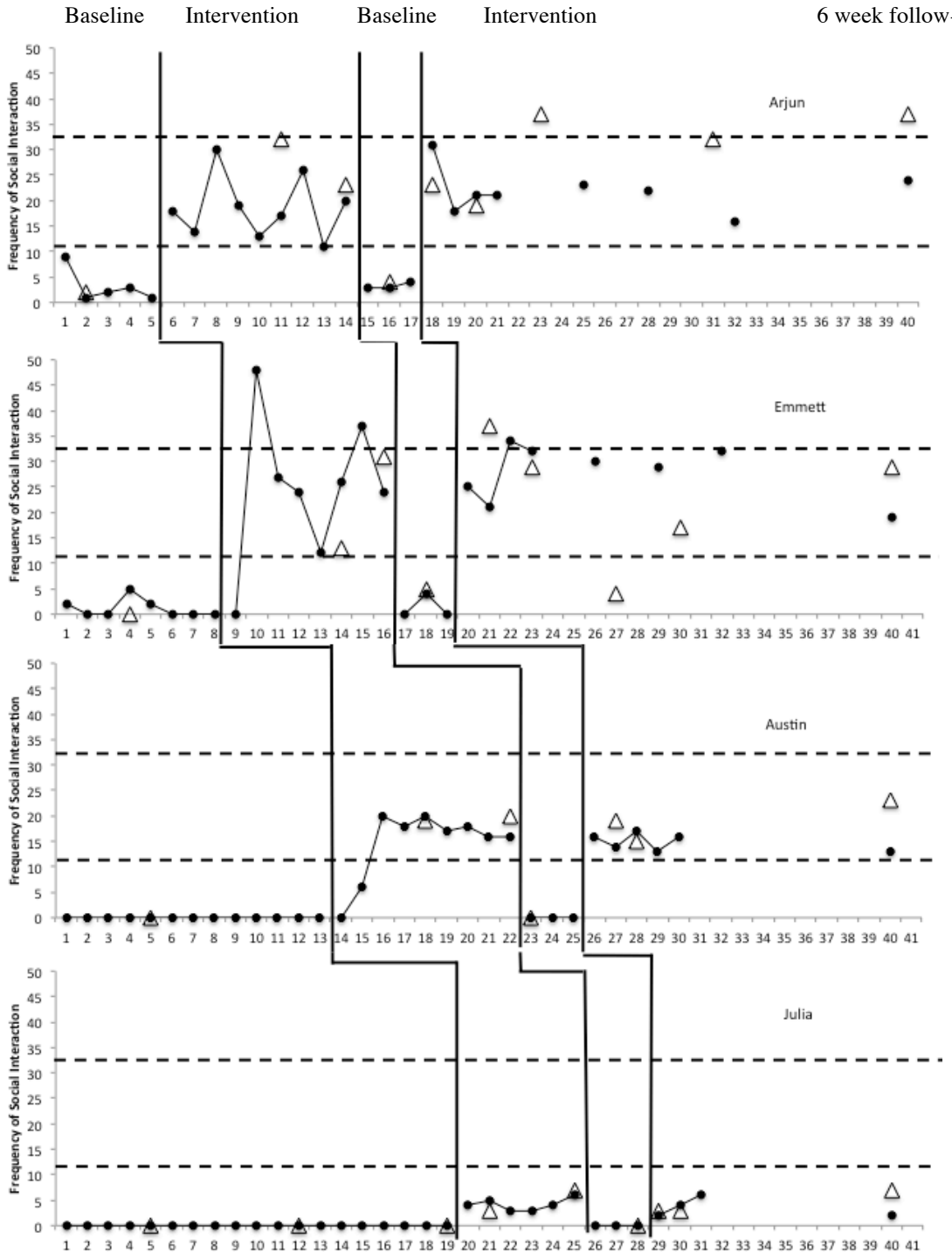


Figure 2. Frequency of social interactions participants directed to typically developing peers during ten-minute play sessions. Triangles indicate generalization probes with novel peer partners. Dashed horizontal lines indicate the range of social interaction behaviors made by typically developing peers during play sessions.

Figure 3 displays the frequency of initiations and responses participants directed to typically developing peers during each play session. Overall, 48.3% of Arjun's peer interactions during intervention were initiations made to a peer (M = 10.8; range = 4 – 18) and 51.7% were responses to a peer's initiation (M = 12.0; range = 2 – 25). With a few exceptions (e.g., session 26), these percentages remained stable throughout treatment. Emmett's overall percentage of initiations and responses were 39.7% (M = 9.9; range = 3 - 19) and 60.3% (M = 16.2; range = 5 – 44), respectively. Initially, Emmett exhibited high numbers of responses to peers and comparatively fewer initiations. However, as the intervention progressed, his number of initiations to peers increased greatly, and by session 25 the number of initiations and responses were roughly equal per session. Austin consistently exhibited higher numbers of responses than initiations throughout the intervention. Responses to peers constituted 83.6% of his social interactions (M = 13.0; range = 0 – 21), and initiations to peers constituted 16.4% of his interactions (M = 2.85; range = 0 – 8). Of Julia's peer interactions, 45.9% were initiations (M = 1.9; range = 0 – 4) and 54.1% were responses (M = 2.3; range = 1 – 5). These percentages remained stable throughout the intervention.

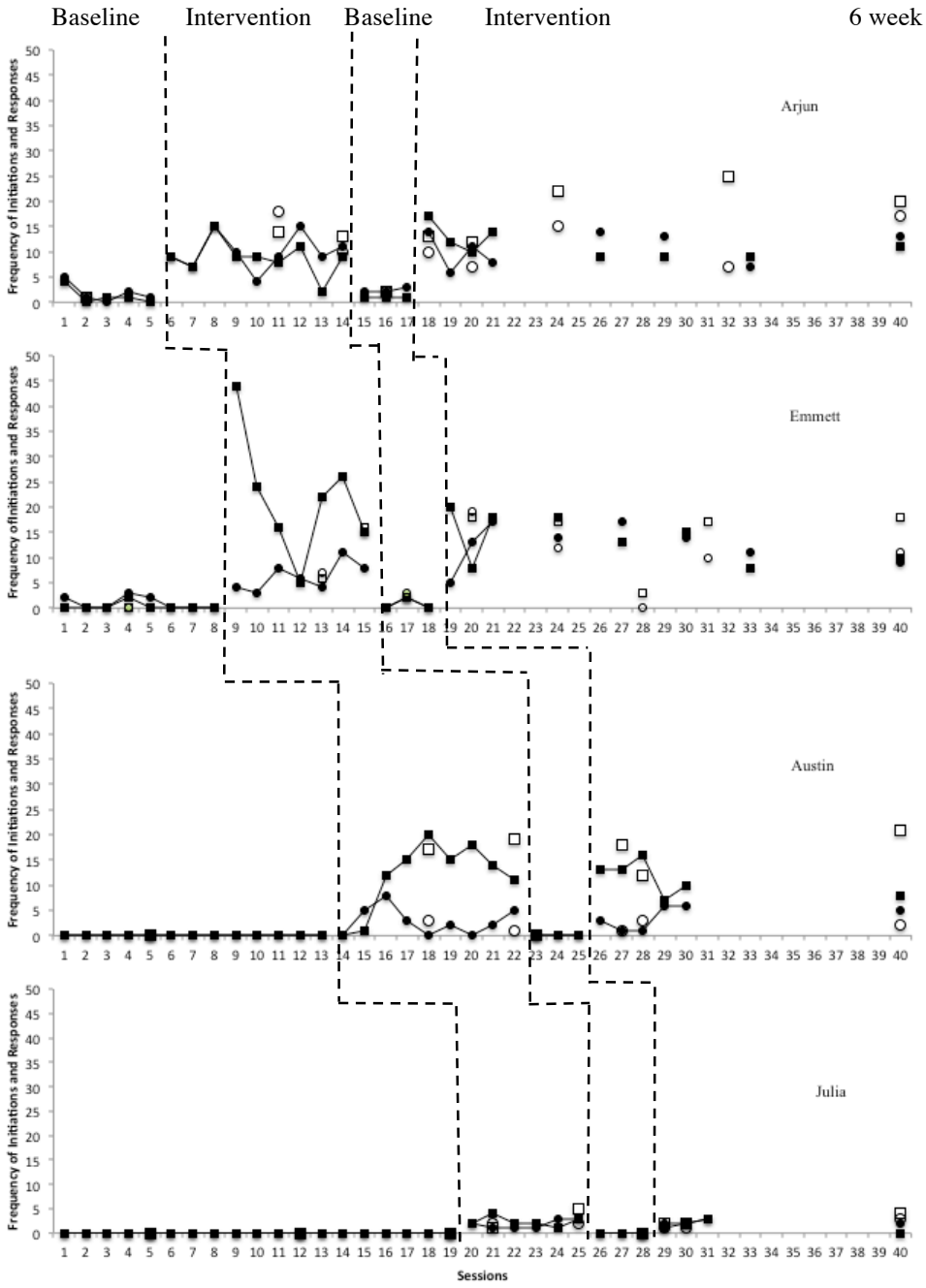


Figure 3. Frequency of participant initiations (closed circles) and responses (closed squares) directed to peer per play session. Open circles indicate initiations to a novel peer during generalization sessions. Open squares indicate responses to a novel peer during generalization sessions.

Figure 4 displays duration of interactive play. In baseline, Arjun engaged in interactive play with his peer for an average 8% of the time during the 10-minute play session (range = 3% - 16%). During intervention sessions, Arjun engaged in interactive play for an average 79% of the time in the play sessions (range = 66% - 90%). In baseline, Emmett engaged in interactive play with his peer for an average 1.3% of the time during the 10-minute play sessions (range = 0% - 5%). During intervention sessions, Emmett engaged in interactive play for an average 73% of the time in the play session (range = 49% - 100%). In baseline, Austin engaged in interactive play with his peer for 0% of the time during the 10-minute play sessions. During intervention sessions, Austin engaged in interactive play for an average 47% of the time in the play session (range = 30% - 62%). %). In baseline, Julia engaged in interactive play with her peer for an average 0.6% of the time during the 10-minute play sessions (range = 0% - 4%). During intervention sessions, Julia engaged in interactive play for an average 33% of the time in the play session (range = 11% - 92%).

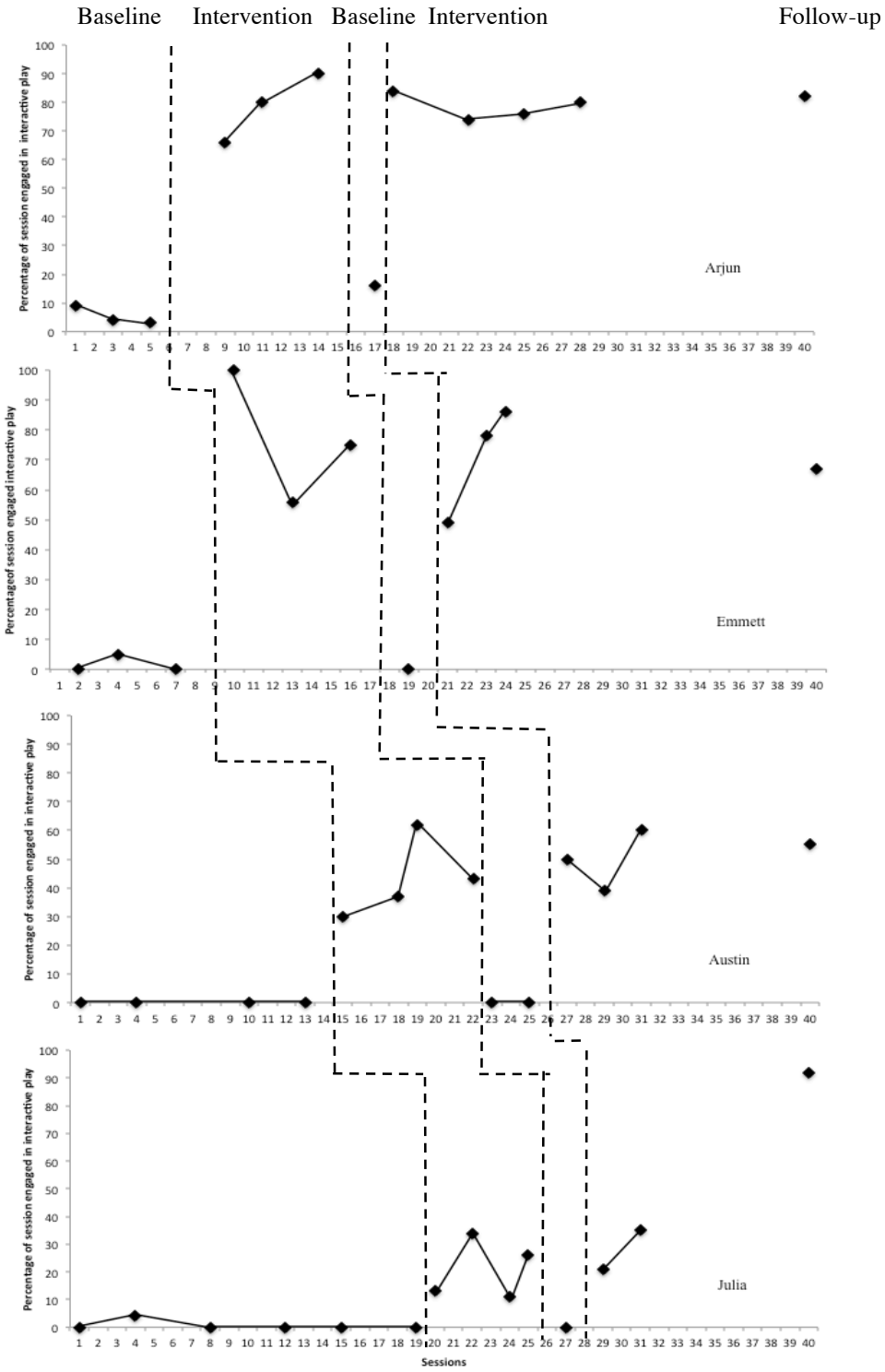


Figure 4. Percentage of time the participant and peer engaged in interactive play during 10-minute play sessions.

GENERALIZATION

Generalization probes with novel peers were conducted during all phases of the study. Novel peers were typically developing classmates but not the usual peer partner that played with the participant during baseline and treatment sessions. During the baseline generalization sessions, Arjun exhibited an average of 3 interactions (SD = 1.4), with an average of 1.5 (SD = 0.7) initiations and 1.5 (SD = 0.7) responses, and Emmett exhibited an average of 2.5 interactions (SD = 3.5), with an average of 1.5 (SD = 2.1) initiations and 1 (SD = 1.4) response. Austin and Julia exhibited zero interactions, initiations, and responses with a novel peer during baseline generalization sessions. During generalization intervention sessions, Arjun exhibited an average of 29 (SD = 7.2) interactions with a novel peer, with an average of 12 (SD = 4.6) initiations and 17 (SD = 5.2) responses; Emmett exhibited an average of 24.1 (SD = 11.8) interactions, with an average of 10.6 (SD = 6.0) initiations and 13.5 (SD = 6.2) responses; Austin exhibited an average of 19.4 (SD = 2.8) interactions, with an average of 2 (SD = 1) initiations and 17.4 (SD = 3.3) responses; and Julia exhibited an average of 4.6 (SD = 2.2) interactions, with an average of 1.8 (SD = 0.8) initiations and 2.8 (SD = 1.6) responses. These levels of interaction with a novel peer were consistent with the levels of interaction found with the regular peer partner throughout both baseline and intervention phases.

MAINTENANCE

Maintenance was assessed at six weeks following the completion of the intervention. During maintenance probes, the preferred activity remained in place during play sessions. Probes were conducted with both the regular peer partner and a novel peer

partner. At follow-up, Arjun exhibited an average of 30.5 (SD = 9.2) peer social interactions, with an average of 15 (SD = 2.8) initiations and 15.5 (SD = 6.3) responses; Emmett exhibited an average of 24 interactions, with an average of 10 (SD = 1.4) initiations and 14 (SD = 5.6) responses; Austin exhibited an average of 18 interactions, with an average of 3.5 (SD = 2.1) initiations and 14.5 (SD = 9.2) responses; and Julia exhibited an average of 4.5 interactions, with an average of 1.5 (SD = 2.1) initiations and 3 (SD = 1.4) responses. These results are consistent with levels of peer social interaction in intervention phases, and place Arjun, Emmett, and Austin within the peer normative range of interaction. Maintenance results for the percentage of time engaged in interactive play remained comparable to or higher than intervention results for all participants, at 83% for Arjun, 67% for Emmett, 55% for Austin, and 91% for Julia.

TAU-U RESULTS

Tau-U results indicated a highly effective intervention, with all results .90 and above. These results, reported in Table 3, compared the amount of behavior change between both baseline phases and the intervention, generalization, and maintenance phases combined. Tau-U results were .96 for Arjun, .90 for Emmett, .95 for Austin, and 1.0 for Julia. Scores for all participants indicated statistically significant ($p < 0.0001$) effects.

Table 3. Tau-U effects between baseline and preferred interest intervention, including generalization and maintenance conditions.

	Tau-U	*p* value	95% CI
Arjun	.96	$p < 0.0000$	[0.52, 1]
Emmett	.90	$p < 0.0001$	[0.46, 1]
Austin	.95	$p < 0.0000$	[0.52, 1]
Julia	1.0	$p < 0.0000$	[0.56, 1]

Effect sizes for Tau-U are considered large if at or above .80, moderate if ranging from .21 to .79, and small if below .20.

SOCIAL VALIDITY ASSESSMENT

Participants' levels of social interaction were compared to those of typically developing classmates, with results indicating that three of the four participants interacted with peers at rates within the normative range during the intervention. The classroom teacher interview at the conclusion of treatment indicated a high rate of satisfaction with the intervention, and the teacher indicated that she would be able to implement the intervention independently within the normal classroom routine and that she would use this strategy in the future. In addition, she noted that most of her students, both with and without ASD, would likely be able to successfully participate in the intervention. She also expressed that Arjun, Emmett, and Austin were more included in classroom activities throughout the day as a result of the intervention. For Emmett, she noted that he was "much more interested in the other kids than during pre-intervention". For Austin,

the teacher reported that she had “definitely seen him branch out” and that he was “much more comfortable having other kids in his space than pre-intervention”.

Results of the social validity assessment also indicated that the behavior changes of the participants between baseline and intervention conditions were large enough for practical significance. The survey questions, mean score, standard deviation, and *p* values for all items across participants in baseline and intervention conditions are reported in Table 4.

Based on the Wilcoxon signed-rank test, statistically significant results ($p < .005$ for all items) indicated that raters perceived participant interactions to be more positive in intervention conditions than in baseline conditions. Raters observed that all children with ASD participated appropriately in a shared social activity, displayed more typical play skills, interacted more regularly with their peers, seemed to enjoy playing more, and were engaging in more agreeable interactions during intervention versus baseline conditions.

The findings of the social validity assessment corresponded closely with intervention results. The pre-service teachers rated Emmett most highly overall, with scores ranging from 1.11 - 1.67 in baseline to scores ranging from 4.78 - 4.89 in intervention, which indicates that his interactions during intervention play sessions improved to a level considered appropriate and reflective of play skills exhibited by typically developing peers. Raters also found marked differences in the quality of social interaction between baseline and intervention phases for Arjun, with baseline ratings ranging from 1.23 - 2.33 and intervention ratings ranging from 3.83 - 4.50. Arjun received high marks for participating appropriately in a shared social activity (4.50) and

interacting regularly with a peer during the preferred interest play session (4.17). Scores for Austin also showed great improvement during treatment, and he was rated from 1.06 - 1.50 in baseline to 3.28 - 4.28 in intervention, with ratings for participating appropriately in a shared social activity receiving the highest score. Ratings for Julia increased from 1.11 - 1.67 in baseline to 2.17 - 3.89 in intervention. Although Julia's increases in ratings are more modest compared to the other participants, they do reflect a marked improvement from baseline ratings.

Table 4. Social Validity Assessment

Survey questions were rated on a Likert-type scale of 1 to 5 representing the least and most positive values, respectively.

1. The target child and his peer participate appropriately in a shared social activity.
2. The target child interacts regularly with his peer during the play session.
3. The target child displays play skills typical for his age.
4. The children appear to enjoy playing together.
5. A teacher would find this interaction agreeable/likeable.

Raters' (n = 18) mean scores (*M*) and standard deviations (*SD*) for survey items between baseline and preferred activity intervention conditions. Wilcoxon signed-rank test was used to evaluate the change (*p* value) between baseline and intervention conditions.

Participant	Items	Conditions				
		Baseline		Intervention		
		M	*SD*	*M*	*SD*	*p* value
Arjun						
	1	1.39	0.41	4.50	0.50	$p < 0.005$
	2	1.23	0.59	4.17	0.60	$p < 0.005$
	3	2.50	0.83	3.83	0.83	$p < 0.005$
	4	1.78	0.78	4.12	0.50	$p < 0.005$
	5	2.33	0.74	4.12	0.50	$p < 0.005$
	average	1.84	0.86	4.17	0.64	$p < 0.005$
Emmett						
	1	1.11	0.31	4.89	0.31	$p < 0.005$
	2	1.11	0.31	4.89	0.31	$p < 0.005$
	3	1.61	0.67	4.78	0.41	$p < 0.005$
	4	1.56	0.76	4.89	0.31	$p < 0.005$
	5	1.67	0.81	4.83	0.37	$p < 0.005$
	average	1.41	0.66	4.86	0.35	$p < 0.005$
Austin						
	1	1.11	0.22	4.28	1.19	$p < 0.005$
	2	1.06	0.31	3.28	1.04	$p < 0.005$
	3	1.5	0.61	3.94	0.97	$p < 0.005$
	4	1.44	0.68	3.61	0.89	$p < 0.005$
	5	1.44	0.59	3.78	0.91	$p < 0.005$
	average	1.31	0.55	3.78	1.06	$p < 0.005$
Julia						
	1	1.11	0.55	3.89	0.89	$p < 0.005$
	2	1.22	0.32	2.17	0.80	$p < 0.005$
	3	1.44	0.54	2.89	0.99	$p < 0.005$
	4	1.67	0.74	2.72	0.44	$p < 0.005$
	5	1.50	0.50	2.94	1.02	$p < 0.005$
	average	1.39	0.57	2.92	1.02	$p < 0.005$

Experiment 2 Results

STEREOTYPY AND FUNCTIONAL PLAY

Figure 5 depicts the percentage of intervals the participant engaged in stereotypy during play sessions with a typically developing peer across each phase of the study. Figure 6 depicts the percentage of intervals the participant engaged in functional play during play sessions with a typically developing peer across each phase of the study. During baseline, Austin exhibited high levels of stereotypy in each session (M = 80.25%, range = 53.9% - 98.3%) and rarely demonstrated functional play skills (M = 4.5%, range = 0 – 26.9%). Immediately following the implementation of the preferred interest play activity, stereotypy decreased (M = 19.8%; range = 7.5% - 29.5%), and Austin demonstrated increases in functional play skills (M = 47.9%; range = 35.3% - 76.7. Similarly, during the second implementation of baseline conditions, the percentage of stereotypy per session increased (M = 67.2%; range = 58.62% - 73.68%), and functional play (M = 1.2%; range = 0% - 4.8%) decreased. With the return of the intervention, stereotypy again returned to lower levels (M = 21.3%; range = 20.6% -22.4%), and functional play increased (M = 39.5%; range = 35.5% - 44.8%).

GENERALIZATION AND MAINTENANCE

Generalization probes with novel peers during each phase reflected levels of stereotypy found with the usual peer partner in each phase. Stereotyped behavior during maintenance probes was slightly higher than during intervention sessions (M = 38%; range = 32.5% - 43.3%), but levels were still lower than in baseline sessions. Functional

play during maintenance probes remained at levels similar to those during intervention at 41.7%.

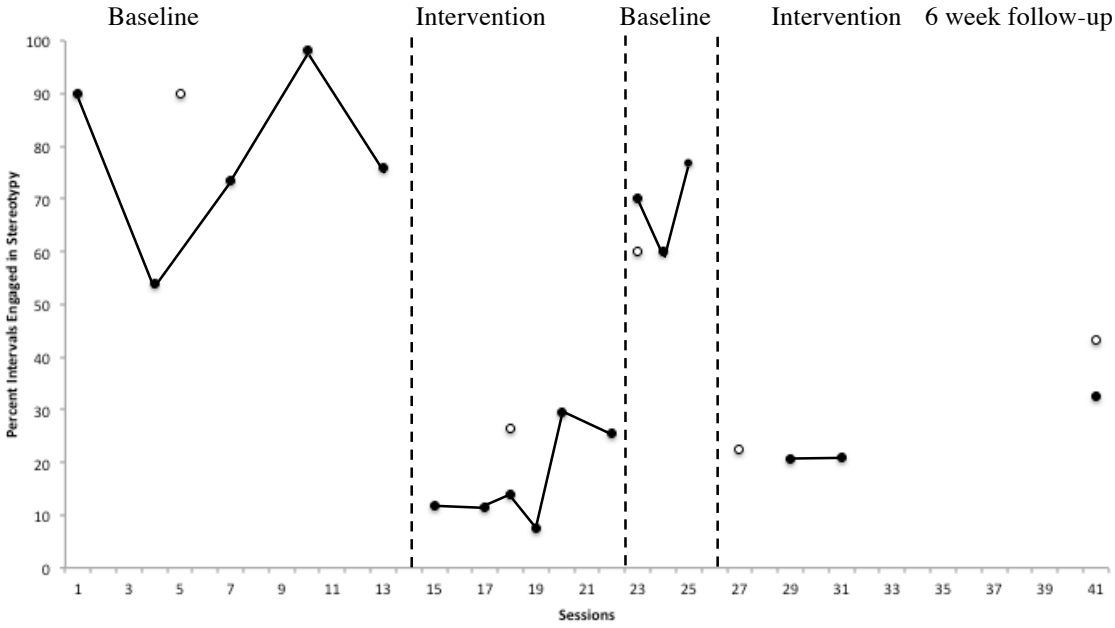


Figure 5 Percentage of intervals participant engaged in stereotypy (closed circles) during play sessions with a typically developing peer. Open circles indicate generalization probes with a novel peer.

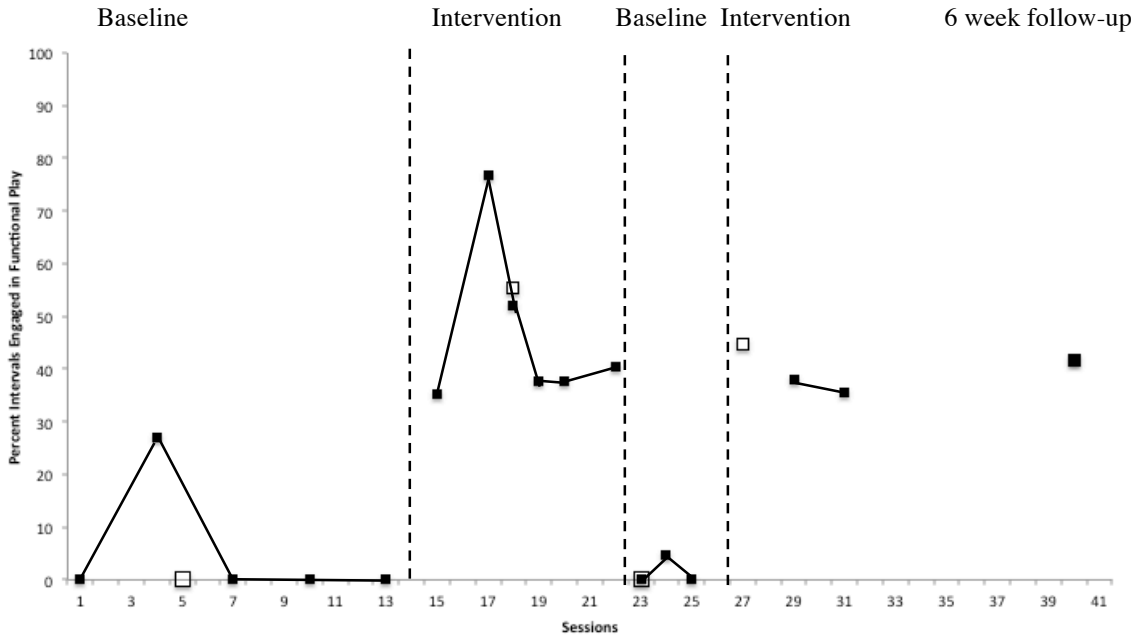


Figure 6 Percentage of intervals participant engaged in functional play (closed squares) with a typically developing peer during play sessions. Open squares represent generalization probes of functional play with a novel peer.

TAU-U RESULTS

Tau-U results indicated a highly effective intervention, with results for both stereotypy and functional play 1.0. These results, reported in Table 5, compared the amount of behavior change between both baseline phases and the intervention, generalization, and maintenance phases combined.

Table 5. Tau-U effects between baseline and preferred interest intervention, including generalization and maintenance conditions.

	Tau-U	*p* value	95% CI
Stereotypy	1.0	$p < 0.0001$	[0.48, 1]
Functional play	1.0	$p < 0.0003$	[0.46, 1]

Effect sizes are considered large if at or above .80, moderate if ranging from .21 to .79, and small if below .20.

SOCIAL VALIDITY ASSESSMENT

Results of the social validity survey indicated that the teacher expressed a high level satisfaction with the intervention, that the strategy was feasible to implement within the normal classroom routine, and the teacher would be able to implement the procedures independently without the assistance of the researchers. The teacher also observed and reported that Austin was more included in classroom activities with his peers following the intervention. Anecdotal feedback provided by the peers indicated that they enjoyed playing with Austin and liked the play activities. The usual peer partner always willingly played with Austin but did occasionally express an interest in playing with a wider variety of games and toys beyond the preferred interest play activity present during intervention sessions.

Chapter 5: Discussion

The purpose of this study was to assess the effects of incorporating the preferred interests of students with ASD into play activities with typically developing peers on social interaction behaviors (i.e., initiations, responses, and interactive play). Further, the study also assessed whether this strategy would occasion gains in other skills domains (i.e., stereotypy and functional play) for one participant. Four young children with ASD and four typically developing peers participated in this study. During free play baseline sessions, little to no interaction between students with and without ASD was observed. After establishing a preferred interest of the student with ASD that was also mutually appealing to the typically developing classmate, these interests were systematically incorporated into play activities. Upon implementation of the intervention, initiations, responses, and the time spent engaged in interactive play with peers increased for all participants with ASD. In addition, for a participant exhibiting persistent stereotyped behaviors, stereotypy decreased and functional play increased during intervention sessions. This intervention is hypothesized to be effective because the highly preferred interest is inherently reinforcing; thus, motivation to interact with peers within this specific context may be increased.

This chapter will review the results of the study with respect to the following research questions: 1.) Will the incorporation of the preferred interests of preschoolers with ASD into activities with typical classmates increase peer interaction for a variety of participant profiles, ranging from high to low functioning ASD diagnoses? 2.) Will intervention results generalize to novel peers and maintain following the intervention? 3.)

Will this strategy additionally occasion improvements in other skill domains? 4.) Is this intervention feasible in an inclusive classroom environment according to multiple indicators of social validity?

This chapter will first address the importance of the dependent variable (i.e., social interaction) in relation to the suitability of this intervention strategy, then address the results of the study as they pertain to each research question, and finally conclude by offering recommendations for future research.

Importance of Peer Interaction for Children with ASD

When children enter school, their social context naturally expands to include their peers. Friendships with peers outside of the family become important, and the child learns to socially engage with classmates through play, sharing, and cooperating in joint activities. Developing appropriate social skills at this age can positively influence a child's success in school, emotional wellbeing, and quality of life (Carter et al., 2010; Rubin et al., 2009). Successful peer interaction also presumably provides these same benefits to children with ASD, and opportunities for children with ASD to interact regularly with their typically developing peers has increased, in part due to an increase in inclusive educational practices wherein students with disabilities share the same context as typically developing classmates (Carter & Hughes, 2005; DiSalvo & Oswald, 2002; Koegel et al., 2012; Kohler et al., 1997). Given the amount of time children both with and without disabilities spend in school, inclusive classroom settings would seem a natural context in which to develop peer relationships (Wentzel, 2005).

However, due to the social deficits and difficulties with social interaction that are

central to autism spectrum disorder, interacting with typically developing peers is especially challenging for children with ASD (APA, 2013). Children with ASD exhibit social deficits that can include difficulties initiating interaction, responding to initiations made by others, and maintaining social engagement, and these impairments are present regardless of cognitive or language ability (Koegel, et al., 2008; Volkmar et al., 1997; White et al., 2007). Despite inclusion in settings with typically developing peers, limited interaction and social acceptance between children with ASD and their typically developing classmates tends to occur (McConnell, 2002; Odom et al., 2006; Pierce & Schreibman, 1997). Given the difficulties children with ASD have with social interaction, interventions must be employed in order to increase interaction with typically developing peers in this setting.

Interventions Effects on Peer Social Interaction

The results of this study demonstrate that an antecedent intervention utilizing the preferred interests of young children with ASD in play activities that are also appealing to typically developing classmates can produce large increases in peer social interaction in inclusive early childhood settings. This strategy produced increases in social initiations, responses, and time spent engaged in interactive play with peers without the need for utilizing additional social skills intervention, reflecting findings from previous research utilizing this strategy with older and higher functioning children with ASD (e.g., Baker et al., 1998; Boyd et al., 2006; Koegel et al., 2012a, 2012b, 2013). This study also extends previous research by including younger children who present with more severe symptoms of ASD, assessing for generalization throughout all phases of the study, providing

maintenance data for all participants, and assessing gains in multiple skill domains. Positive results were demonstrated in each of these areas.

Given the promising effects of the intervention for participants with a range of functioning, this strategy could potentially be generalizable to participants with diverse characteristics. Although social deficits were present, Arjun exhibited well-developed verbal skills and the least number of autistic symptoms, and his increase in peer social interaction reflects findings of previous studies using similarly high functioning participants with strong verbal communication (e.g., Baker et al., 1998; Boyd et al., 2007; Koegel et al. 2012a, 2012b, 2013). This study also extends those findings to moderate and lower functioning participants. The intervention was also highly effective for Emmett, who lacked strong verbal communication skills but was able to engage in interactive play and increase peer interactions during intervention sessions. Notably, the number of initiations Emmett made to his peer increased as the intervention progressed. This finding reflects results from the literature that suggests preschool children without ASD who exhibit delayed play skills may increase initiations over time without further intervention when paired with a highly competent peer partner (e.g., Tanta et al., 2005).

The intervention was also successful for Austin, who exhibited more severe autistic symptoms. Although his interactions were primarily responses to peer initiations (e.g., following a peer direction or request), Austin began to verbally initiate to his peers (e.g., approximating "your turn") during the intervention, a behavior that had not been previously demonstrated. In addition, his time spent engaged in interactive play with a peer increased considerably as a result of the interventions. Although Julia, the

participant with the most pronounced delays and autistic symptoms, did not increase her levels of peer interaction to within the normative range, she did clearly produce an increase in social initiations and responses to a typically developing peer during intervention compared to baseline conditions. Most notably, the percentage of time Julia spent engaged in interactive play with her peer rose substantially as a result of the intervention.

It is interesting to note that the generalization sessions using novel peer partners often resulted in higher levels of social behavior for Arjun than compared to sessions with his usual peer partner. Although we followed recommendations in the literature for selecting typically developing peer partners (i.e., age appropriate verbal and social skills, compliance with teacher directions, and a history of offering to help classmates), and the peer willingly participated in the play activities, the generalization peer partner appeared to enjoy the activities more so than the usual peer partner. This could have perhaps increased the novel peer's motivation to interact with the participant during the play session, thus contributing to higher levels of participant initiations and responses. In addition to the established typical peer selection criteria, practitioners should consider how closely the interests of the peer and participant align and make adjustments accordingly. Similarly, when implementing play sessions incorporating preferred interests, teachers should consider utilizing multiple peers across play sessions so that the child with ASD has access to a variety of play partners as would be typical in classroom play activities.

Intervention Effects on Stereotypy and Functional Play

As indicated in Experiment 2, the intervention was successful in improving behavior in skill domains other than social interaction. Specifically, this strategy also reduced stereotypy and increased functional play for one participant. During baseline free play sessions, Austin exhibited high levels of stereotypy and little functional play; however, with the implementation of the peer play activity incorporating his restricted or preferred interests, stereotypy decreased as functional play simultaneously increased.

This finding is consistent with research suggesting stereotypy is more likely to occur in the absence of preferred activities (Kennedy et al., 2000), and extends findings that have shown that antecedent intervention strategies alone may be effective in reducing some stereotypical behaviors (Lang et al., 2010; Reed et al., 2011). In addition, functional play skills simultaneously increased during the preferred interest play activity. This finding is consistent with research suggesting that it may be possible to produce an increase in functional play skills by implementing play activities that utilize aspects similar to the stereotyped behavior (Lang et al., 2009; 2010; Rapp et al., 2004).

Although the findings are promising, these results should be interpreted cautiously. It is unknown if this approach would be effective for stereotyped behaviors that are maintained by socially mediated variables. Austin's stereotypy was maintained by non-social variables, and it is possible that the intervention was effective because it served the same function as Austin's stereotypy. Replications with participants with diverse characteristics are essential in order to improve the generalizability of this approach and advance evidence-based practice.

Social Validation

As discussed in Chapter 2, interventions for students with ASD in school settings that demonstrated multiple indicators of social validity tended to produce the most robust results, possibly because interventions that practitioners in these settings consider time and cost effective, target outcomes appropriate to the inclusive classroom setting, and provide measures of comparison to typically developing students increase practitioner "buy in" and their willingness to implement intervention procedures with fidelity. That this intervention is both an effective and socially valid practice provides support for the use of this strategy in inclusive classroom settings.

This intervention strategy offers educators in inclusive early childhood settings a potentially effective and efficient strategy for producing increases in social behavior in children with ASD and their typically developing peers. The intervention did not require direct training for either participants or peers, and the play sessions did not necessitate extensive adult involvement, instead allowing the adult to monitor rather than direct the children's interaction (Odom, 1991). Such approaches may be considered more ecologically and socially valid than approaches requiring ongoing coaching and feedback to support treatment fidelity (Rispoli et al., 2011). In addition, the intervention took place within the natural environment and fit within the context of the daily routine. Unlike some other studies utilizing the preferred or circumscribed interests of young children with ASD, this intervention did not require the creation of novel materials or games (e.g., Baker, 1998), instead utilizing those items typically found in an early childhood setting. This ease of implementation would seem especially attractive to educators in inclusive

settings who may not necessarily have specialized knowledge of evidence-based behavioral strategies for student with ASD (Pazey et al., 2014; Segall & Campbell, 2012).

Multiple measures of social validation with positive findings, including teacher feedback, comparisons to typically developing peers, and observations from unbiased observers, further support the use of this intervention strategy. The classroom teacher expressed a high level satisfaction with the intervention, both with the outcomes targeted and the intervention results, as well as the feasibility of implementing the strategy without researcher support within the normal classroom routine. In addition, both the normative data that compared participants' frequency of social interactions to typically developing peers and the survey results from unbiased observers evaluating participant and peer interactions indicate that this intervention improved social behavior for most participants to levels that were comparable to that of their classmates. These measures of social validity are of particular importance in developing and recommending interventions for students with ASD in school settings. Such information is necessary in order to guide evidence-based practice and identify interventions that are likely to be adopted by educators working with this population of students (Carter & Pesko, 2008).

Limitations

Although this study resulted in improved social behavior for all participants, a notable limitation is the lack of assessment of generalization across different types of organized play activities other than the preferred interest play activities utilized in the intervention. Future studies should investigate if the participants' increases in social

interaction extend across settings and to other types of organized play activities that include adult modeling and verbal explanation but do not incorporate highly preferred interests. In addition, although adult modeling and verbal explanation was not provided in every intervention session, these components may have influenced results, and future studies might attempt to analyze the effects of the preferred interest play activity in isolation and introduce these additional components if needed. Finally, data was not reported on the typically developing peers' initiations and responses beyond establishing the normative range of interaction. As social interaction is a reciprocal process, future research that explores how peer initiations and responses may also change as a result of the intervention could provide a more nuanced analysis of intervention effects.

Recommendations for Future Research

The findings from this study offer several relevant recommendations for future research. For students like Austin or Julia with more substantial social communication impairments, an approach that utilizes additional social skill intervention strategies such as initiations training (e.g., Koegel et al., 2014) or direct peer training strategies (e.g., English et al., 1997), along with the preferred activity intervention, may produce even greater gains in peer social interaction and would seem a promising area for future research.

Future studies might also systematically assess how participant behavior changes as a result of the intervention beyond an increase in social interaction, functional play, and stereotypy. Changes in the quality of the children's interactive play between baseline and intervention conditions were anecdotally observed. For example, during baseline

sessions Arjun engaged mostly in solitary play and onlooker behavior (i.e., observing his peer playing with other materials but not interacting), but within the context of intervention sessions, he engaged in multiple types of interactive play, namely associative play behaviors (i.e., interacting with the peer while playing but not coordinating actions) and cooperative play (i.e., playing with a shared goal and defined roles; Parten, 1932). Similarly, Emmett engaged in mostly unoccupied behavior or solitary play behavior in baseline sessions but exhibited cooperative interactive play with his peer during intervention sessions. Although the interactive play probes provided a measure reflecting this behavior change, future studies might include more nuanced measures of the type of interactive play in order to provide a more detailed analysis of the interaction.

Finally, future research should consider whether deficits in social interaction are caused by a skill deficit (i.e., lack of ability) or a performance deficit (lack of interest or motivation) when developing interventions for children with ASD. Deficient social motivation appears in the earliest conceptualizations of autism (e.g., Kanner, 1943), and some research and commentaries suggest that an extreme diminishment in social motivation may constitute a primary deficit of the disorder (Chevallier et al., 2012; Koegel & Koegel, 1995). The results of this study seem to support the social motivation theory of autism, and findings suggest that without direct skill instruction, incorporating preferred interests into social activities might potentially increase the motivation of some children with ASD to interact with their peers. Interventions targeting skills in a developmentally sequential fashion may not then be necessary for some children with

ASD, and research that further elucidates the relationship between social motivation and skill use and development seems warranted.

Conclusion

In summary, this study systematically assessed the effects of incorporating the preferred interests of young children with ASD into play activities also appealing to typically developing classmates in order to improve peer-to-peer interaction. This intervention approach produced increases in social interaction for participants with a wide range of functioning and these gains generalized to novel peer partners. In addition, an increase in the duration of interactive play was observed for all participants, and, for one participant, stereotypy decreased and functional play increased. Furthermore, the intervention was simple and efficient, fitting easily within the normal classroom routine. Future studies examining the training of preschool educators to implement this strategy in inclusive classroom settings are merited.

Appendices

Appendix A

Participant: Session #:
Peer: Condition:
Date: Time:
Observer Initials: Researcher Initials:

Tally each initiation a participant directs toward a peer and each participant response to a peer's initiation.

Initiations:	Responses:

Total Interactions:
Total Initiations:
Total Responses:

Appendix B

Participant:
Session #:
Condition:
Observer Initials:
Researcher Initials:

Record the interval of time in which interactive play between the participant and peer starts and the time it finishes.

Start Time	End Time	Duration

Total Time Observed:	10 minutes/600 s
Total Time Engaged in Interactive Play:	
Percentage of Time Engaged in Interactive Play:	

Appendix C

Participant:
Session #:
Condition:
Observer Initials:
Researcher Initials

Intervals with stereotypy: __/__
Percentage:
Intervals with functional play __/__
Percentage:

Record the presence of stereotypy and/or functional play within each interval.

1	S	FP	11	S	FP	21	S	FP	31	S	FP	41	S	FP	51	S	FP		
2	S	FP	12	S	FP	22	S	FP	32	S	FP	42	S	FP	52	S	FP		
3	S	FP	13	S	FP	23	S	FP	33	S	FP	43	S	FP	53	S	FP		
4	S	FP	14	S	FP	24	S	FP	34	S	FP	44	S	FP	54	S	FP		
5	S	FP	15	S	FP	25	S	FP	35	S	FP	45	S	FP	55	S	FP		
6	S	FP	16	S	FP	26	S	FP	36	S	FP	46	S	FP	56	S	FP		
7	S	FP	17	S	FP	27	S	FP	37	S	FP	47	S	FP	57	S	FP		
8	S	FP	18	S	FP	28	S	FP	38	S	FP	48	S	FP	58	S	FP		
9	S	FP	19	S	FP	29	S	FP	39	S	FP	49	S	FP	59	S	FP		
10	S	FP	20	S	FP	30	S	FP	40	S	FP	50	S	FP	60	S	FP		

Appendix D

Fidelity of Treatment Checklist:

1. Researcher introduces preferred activity to participant and peer through modeling (upon first implementation) and verbal explanation.

yes no

2. Researcher answers questions from a participant or peer as needed if it pertains to activity

yes no

3. Researcher does not instruct, prompt, and/or reinforce social interaction behaviors between participant and peer during play activity

yes no

4. Researcher intervenes during play activity if problem behavior from participant or peer arises (e.g., eloping, hitting, pushing, name calling, crying, or other aggressive or dangerous acts)

yes no

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Vita

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